Population Assessment of Snow Crab, *Chionoecetes opilio*, in the Chukchi and Beaufort Seas, Including Oil and Gas Lease Areas

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FINAL REPORT
August 2015
OCS Study BOEM 2015-029

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COASTAL MARINE INSTITUTE

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Executive Summary

The snow crab, *Chionoecetes opilio* is widely distributed in offshore waters of high latitudes including the Chukchi Sea and parts of the Alaska Beaufort Sea where oil and gas lease sale areas are located. This cold-water crab is not commercially harvested in United States (U.S.) high Arctic waters, but it supports major fisheries in the eastern Bering Sea, the Canadian North Atlantic, coastal Greenland and the Barents Sea. Limited knowledge of the snow crab population structure in the Chukchi and U.S. Beaufort Seas, in combination with increasing human activity in those areas and recent changes in *C. opilio* distributions on sub-Arctic and Arctic shelves have prompted this study. This study was intended to provide new information on the snow crab stock in the Chukchi and Alaska Beaufort Seas to improve current baseline knowledge for risk assessment and environmental analysis. Specifically, our goals were to (1) assess snow crab distribution, size structure and sex composition, (2) determine abundance and biomass, (3) determine reproductive capacity of female crabs, and (4) identify diet and trophic position of snow crab.

Data and/or samples were collected between 2004–2013 from various projects by the principal investigators and their colleagues. Communication with the Alaska Department of Fish and Game ensured compatibility of lab methods with those employed during their regular Bering Sea trawl surveys; however, we based our abundance and biomass estimates on a smaller trawl used on most of the cruises that provided crabs for this project. Standard lab methods included morphometric measurements of body size (carapace width = CW) and weight, chela height for males, determination of sex and maturity status based on belly flap shape for females, and shell condition index. Female fecundity was quantified by determining clutch size and the number of eggs per female in a clutch, and sperm storage was measured by weighing spermathecal load and determining the number of sperm layers in the spermathecal load. Trophic ecology was characterized by frequency of occurrence of prey items in crab stomachs, and by analysis of stable isotope ratios of carbon and nitrogen in muscle tissue of crabs.

Snow crabs occurred throughout the Chukchi Sea > 25 m, on the western Beaufort Sea shelf (to 200 m), and on the upper slope in the Beaufort Sea (to 500 m). Crabs were present in the northeastern Chukchi Sea oil and gas lease areas, but essentially no crabs occurred in the Beaufort Sea lease areas. Abundance and biomass were highest in the southern Chukchi Sea and lowest in the eastern Beaufort Sea (with virtually no crabs on the shelf in that area), resulting in large differences in mean densities between the Chukchi and U.S. Beaufort Seas (>1000 ind /1000 m^{-2} and < 2 ind /1000 m^{-2}, respectively). Temporal data resolution was too sparse to determine potential cyclic patterns (especially in the Beaufort Sea), but variable abundance and biomass patterns in the Chukchi Sea suggest interannual variability in standing stock size.

Mature females appeared to be concentrated in the central parts of the Chukchi Sea, while the few females found in the Beaufort Sea occurred on the shelf break and upper slope. Generally, all crabs in the Chukchi Sea were small (primarily <60 mm CW), irrespective of maturity status and gender. Large male crabs (> ~80 mm CW) occurred exclusively on the Beaufort Sea slope. We cannot conclude from this study if these larger size classes conduct ontogenetic migrations from shallower to deeper waters as seen in the Bering Sea; however, applying the chela height to CW ratio used in

the Bering Sea suggests that all measured males from the Chukchi Sea were immature. This conclusion seems unlikely given that 14% of female *C. opilio* in the Chukchi Sea were mature and essentially all were egg-bearing. Their widespread occurrence and full egg clutches strongly suggest local reproduction occurs in the Chukchi Sea, including the Chukchi lease areas. However, very small (recently settled) crabs were primarily found in the southern Chukchi Sea and very few (only in 2014) small crabs and no egg-bearing females were found in the Beaufort Sea. This pattern suggests that larval supply from the Bering Sea probably plays a large role in maintaining the population north of Bering Strait by adding to Chukchi-reared larvae.

Fecundity of Chukchi Sea female *C. opilio* scaled to body size, as it does in other areas, and ranged from <5000 to >50,000 eggs per female over a size range of 36–64 mm CW. Based on a Bering Sea shell condition index, about a quarter of mature females were multiparous. Most females stored one sperm layer only, but a maximum of four layers was found. By weight, low to moderate amounts of sperm (as defined by Sainte-Marie et al. 2002) were stored. We cannot conclude whether the stored sperm would be sufficient to produce a subsequent clutch without re-mating. None of the few mature females found in the Beaufort Sea carried eggs.

Snow crabs from the Chukchi and Beaufort Seas were omnivorous predators, as they are in other areas, with prey including a broad range of invertebrates such as polychaetes, bivalves, crustaceans, fishes, and cannibalism on juvenile individuals. Regional diet differences were most prominent between the central/Canadian Beaufort Sea and the Chukchi/western Beaufort Sea and were coincident with size differences of crabs. Stable nitrogen isotope values indicated a high trophic position in the food web and some difference in feeding preferences of male and female crabs.

The combined results from this and other recent studies suggest that snow crabs are an integral part of the benthic communities of the Chukchi and western Beaufort Seas. They contribute (in some areas substantially) to benthic biomass, and to food web connections through their opportunistic predatory feeding mode. Their high trophic level makes snow crabs potentially vulnerable to bioaccumulation of contaminants. The occurrence and fecundity of egg-bearing females in the Chukchi Sea appears to successfully sustain, or at a minimum supplement, the regional component of what recent studies suggest is a panmictic population, although the degree of dependence on larval supply from the Bering Sea versus local reproduction remains unquantified. The drastic difference in body sizes between snow crabs in the Chukchi and Beaufort Seas could be interpreted as ontogenetic migration, but these differences, and large differences observed in crab density, remain puzzling and warrant further study.

In summary, our study has substantially advanced our knowledge of snow crab distribution and population characteristics in the Chukchi and Beaufort Seas, and builds a foundation for future impact and climate change studies.

Introduction

Snow crab *Chionoecetes opilio* O. Fabricius is a cold-water brachyuran crab species that is widely distributed in sub-Arctic and Arctic waters around the North American continent. More recently, the species has appeared in the Barents Sea, and a few records suggest it is present on the Russian shelves (Figure 1, from Albrecht 2011).

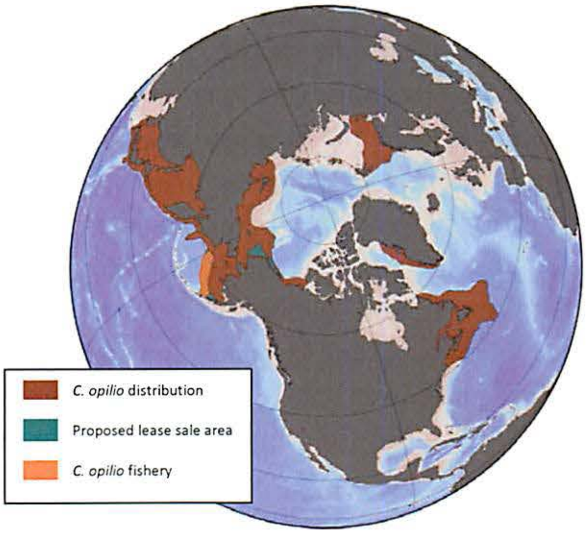

Figure 1. Approximate global distribution of snow crab (modified from Albrecht 2011, with permission).

The interest in snow crab distribution and stock size is primarily related to the multi-million dollar crab fishery active in U.S. waters since the 1970s (Fitch et al. 2012), subsequent declines resulting in an overfished population by 1999 (Zheng et al. 2001), and restoration goals installed in 2000 that remained unsatisfied in 2009 (Turnock and Rugolo 2009). The fishery is regulated by a quota, season, and minimum legal size, the latter preventing the harvest of the much smaller females compared to males. While the U.S. fishery is concentrated in the southeastern Bering Sea, snow crabs also occur on the Chukchi and Beaufort Sea shelves (Paul et al. 1997, Bluhm et al. 2009, Rand and Logerwell 2011, Blanchard et al. 2013, Ravelo et al. 2014). Presumed to have low exploitable biomass and/or small sizes, these high Arctic crab populations are neither commercially harvested (NPFMC 2009) nor regularly monitored (Paul et al. 1997), particularly given the logistical challenges operating in seasonally sea-ice covered waters.

Additional information regarding snow crab distribution, population structure, and reproductive potential is needed for the Pacific Arctic. Oceanographic conditions and crab distribution patterns have changed in recent decades (Orensanz et al. 2004, Mueter and Litzow 2008), and consequently, commercial fishery activities could move from the Bering Sea north into the Pacific Arctic. Specifically, in the southern Bering Sea, warming of near-bottom water temperatures in the 1990s was followed, with a 6-year time lag, by a contraction of the distribution range of mature female *C. opilio* to the north (Orensanz et al. 2004). Also, increased abundance of *C. opilio* has been suggested for the Chukchi Sea (Feder et al. 2005, Bluhm et al. 2009), and snow crab appeared to be more common in the western Beaufort Sea in the 2000s

(Logerwell and Rand 2010) than in the 1970s (Carey 1977). In the Barents Sea, where *C. opilio* was historically absent, an entirely new and now viable population has established over the past two decades (Kuzmin et al. 1998, Alsvåg et al. 2009). The increasing level of human activities in the Arctic (e.g. shipping, oil and gas development, tourism) provides another reason to advance baseline knowledge about potentially important species, such as snow crab.

Concurrent with changing snow crab distributions on a number of Arctic shelves, petroleum-related activities have increased on those same shelves, potentially exposing *C. opilio* to oil and gas-related chemicals in the future. Responses to long-term exposure to persistent petroleum products and other chemicals can be related to the position of a taxon in a food web because the bioaccumulation and biomagnification potential of persistent pollutants contained in petroleum products are dependent on the trophic position of an organism (Borgå et al. 2004). Organisms feeding at high trophic levels have a heightened potential for biomagnification, the concentration of chemicals through dietary absorption (Gobas and Morrison 2000) because persistent compounds can accumulate across several trophic transfers. As omnivorous predators, scavengers and cannibals (Feder and Jewett 1981, Lovrich and Sainte-Marie 1997, Kolts et al. 2013), snow crabs in the Chukchi Sea occupy the highest trophic levels of dominant invertebrates and fishes in the study region (Iken et al. 2010, McTigue and Dunton 2014). In this study, we combine a time-integrated trophic assessment using stable isotope analysis, with stomach content analysis of point-in-time prey taxa, to provide the trophic position of snow crab and assessments of their bioaccumulation and biomagnification potential for different regions of the Pacific Arctic.

Snow crab stock size and structure are strongly shaped by characteristics of the life cycle of the species. In the Bering Sea, reproductive maturity is reached at an average carapace width of 8.4 cm for males and 5.1 cm for females, and size-at-maturity is typically smaller in colder waters at higher latitudes than in warmer temperatures at lower latitudes (Jewett 1981, Orensanz et al. 2007). Males were generally small in the Chukchi Sea in the 1970s and 1990s (<75 mm in carapace width; Frost and Lowry 1983, Barber et al. 1997), yet *C. opilio* with carapace widths as large as 114 mm were collected during a 2008 western Beaufort Sea fish survey (Rand and Logerwell 2011). It is unknown if this size difference reflects an overall increase in crab size in the Pacific Arctic, or if it is specific to the previously unsampled Beaufort slope. It is also unclear whether early benthic life stages occur in the Chukchi and Beaufort Seas, or whether all crabs migrate into the area from the Bering Sea. High connectivity between crabs in the three areas is clear from genetic evidence suggesting snow crabs in the Bering, Chukchi, and Beaufort Seas are a panmictic population (Albrecht et al. 2014). It is important to identify the location and distribution of areas important for reproductive and young crabs in order to assess potential stock sensitivity to oil and gas exploration and extraction activities in the Chukchi and Beaufort Seas.

The reproductive capacity of snow crabs is influenced by their life span, age and size at maturity, duration of egg maturation, and body size, all of which can be influenced by environmental variability (Comeau et al. 1998, Sainte-Marie et al. 2008). Snow crabs are long-lived at ~15–18 years for large males and a few years less for females (Shirley and Bluhm 2005, Fonseca et al. 2008, Ernst et al. 2012). Depending on temperature, females carry a clutch once a year, or every other year, after their terminal molt (Conan et al. 1990, Sainte-Marie 1993). The capability of storing sperm in spermathecae for later fertilization of eggs enhances reproductive potential in snow crab, and brachyurans in general (Gravel and Pengilly 2007, Sainte-Marie et al. 2008). Thus, a female can produce viable clutches in consecutive years following a single mating, and immature females can mate and store sperm (Kruse 1993). Sperm limitation may still arise when insufficient male gametes are available to fertilize all eggs in a population, for example, when a fishery selectively exploits males (Sainte-Marie et al. 2002). In addition, *C. opilio* stock size can be influenced by large interannual fluctuations in recruitment (e.g. 7–8 year cycles in the Gulf of Saint Lawrence and southeastern Bering Sea; Sainte-Marie et al. 1996, Parada et al. 2010), and by temperature-dependent variations in egg incubation time. Below water temperatures of ~1°C, females switch from an annual to a biennial reproductive cycle with diapause periods in embryonic development (Gulf of Sainte Lawrence; Moriyasu and Lanteigne 1998). Bottom water temperatures below ~1°C occur both seasonally and permanently in parts of the Chukchi and Beaufort Seas and may structure female reproductive cycles. However, it is not clear if crabs in the Chukchi and Beaufort Seas are sustained by locally released larvae or by those advected from the Bering Sea.

The Chukchi Sea is outside of the National Oceanic and Atmospheric Administration's (NOAA) regular fish and shellfish survey areas, so there is a lack of historical and continuous data for the region. However, several recent surveys make it possible to comprehensively study snow crab populations in the Chukchi and Beaufort Seas. This study includes areas of interest to the Bureau of Ocean Energy Management (BOEM), specifically, the Chukchi and Beaufort Seas Outer Continental Shelf oil and gas lease areas (Figure 2a) and the larger shelf and slope regions of U.S. territorial waters. The study addressed BOEM research needs by providing information to better understand marine environments potentially affected by offshore oil and gas exploration and extraction.

Objectives and Hypotheses

The overarching goal of this project was to provide a population assessment of snow crabs in the Chukchi and Alaskan Beaufort seas, with a focus on U.S. waters and inclusion of the oil and gas lease sale areas located in the northeastern Chukchi Sea and the western Alaska Beaufort Sea.

Our specific objectives were to:

(1) assess snow crab distribution and population structure,
(2) determine snow crab abundance and biomass,
(3) determine reproductive capacity of female snow crabs, and
(4) identify diet and trophic position of snow crab.

We hypothesized that snow crab densities, stock structure, and diet would exhibit south to north gradients within the Chukchi Sea, and west to east gradients in the Alaskan Beaufort Sea, based on distinct environmental gradients. Specifically, we anticipated lower densities, smaller body sizes and lower fecundity in the northern parts of the study area due to the overall lower temperatures and productivity regimes.

Methods

Field sampling

This project used a combination of previously collected crab data and samples in addition to crabs collected specifically for this project. In total, samples and/or data from 13 surveys, eight in the Chukchi Sea and five in the Beaufort Sea (Table 1), were used in various combinations and subsets for the project objectives, depending on data and crab availability. All surveys were conducted during the open water season, primarily in August/September. Not all data or materials collected during each of these cruises were available to this project, especially in cases where we obtained data from collaborators.

Table 1. List of cruises, projects, and sampling periods during which snow crabs were collected.

Month/Yr	Location	Project	Provided by (lead PI)	Funding
8/2004	Chukchi US, Russia	RUSALCA-1	Iken, Bluhm	NOAA
8/2007	Chukchi US	BASIS	Holladay, Norcross	NOAA
8/2008	Chukchi US	Oshoru Maru IPY	Holladay, Norcross	Japan
8/2008	Western Beaufort US*	Western Beaufort Fish Survey	Logerwell	MMS
8/2009	Chukchi US, Russia	RUSALCA-2	Iken, Bluhm	NOAA
9/2010	Chukchi lease areas	CSESP	Blanchard	Oil Industry
8/2010	Chukchi lease areas	COMIDA	Konar	BOEM
8–9 /2011	Beaufort Sea US	BeauFish	Iken, Bluhm (Norcross)	CMI/BOEM
8/2012	Chukchi US, Russia	RUSALCA-3	Iken, Bluhm	NOAA
8–9 /2012	Chukchi US*	Arctic Eis	Bluhm, Iken (Mueter)	BOEM
9/2012	Western Beaufort Sea	Transboundary	Bluhm, Iken (Norcross)	BOEM
8–9 /2013	Central Beaufort Sea	Transboundary	Bluhm, Iken (Norcross)	BOEM
8–9 /2014	Central Beaufort Sea	Transboundary	Bluhm, Iken (Norcross)	BOEM

*Crabs from 83-112 hauls were included in fecundity and diet studies, but not in abundance and biomass estimates.

The vast majority of all samples were collected with a plumb staff beam trawl (PSBT, after Gunderson and Ellis 1986) with a 2.26 m effective opening and net mesh of 7 mm with a 4 mm cod end liner (Figure 3a). Tow duration ranged from 1–6 min, the area swept ranged from ~100–~1300 m^2, and the towing speed was approximately 1.5 knots. Details on the method can be found in Norcross et al. (2010, 2013). Crabs not collected by PSBT included individuals sampled with a modified 83-112 otter trawl during the Beaufort Sea 2008 survey (Rand and Logerwell 2011) and crabs from the Arctic Eis 2012 survey using an 83-112 eastern otter trawl, which is the standard net for Alaska Fisheries Science Center (AFSC) bottom trawl surveys on the Bering Sea shelf. AFSC standard survey methods were followed during those 83-112 trawls including maintaining a constant vessel speed and monitoring of vertical and horizontal net openings with net sounders (Logerwell et al. 2011).

For mapping distribution, abundance, and biomass estimates of snow crab, we combined survey data from 378 stations sampled during 2004–2013 surveys that used consistent plumb staff beam-trawl gear and deployment procedures (Table 1, Figure 2b). The resulting region-wide map of crab distribution and time-integrated densities may reflect biases due to possibly high interannual and spatial variability in snow crab stock size. Research from the southeastern Bering Sea demonstrated that the species had ontogenetic migrations (Ernst et al. 2005) and a population size cyclic with a 7–8 year period (Parada et al. 2010). Therefore, we identified 2009 and 2012 as the survey years with the highest sampling effort and also mapped abundance and biomass separately for those years. Based on gear comparisons between the plumb-staff beam trawl (see below) and the 83-112 trawl (Bluhm et al. 2014, Britt et al. 2013), we chose not to combine estimates derived by different trawl gears. Abundance and biomass derived from the 83-112 were reported elsewhere for the western Beaufort Sea by Rand and Logerwell (2011) and by the Arctic Eis 2012 survey in the Chukchi Sea (Britt et al. 2013).

Approximately 4100 crabs from across the Chukchi Sea were available to support our analysis of stock structure and size-frequency distribution. Crabs from lease sale areas in the Chukchi Sea were provided by Dr. Konar from the 2010 BOEM-funded COMIDA cruise, and by Dr. Blanchard from the 2010 CSESP survey, with permission from the oil company consortium funders. Only 451 crabs were collected during 2008–2013 surveys of the Beaufort Sea. Subsets of these crabs were used for the fecundity and trophic objectives.

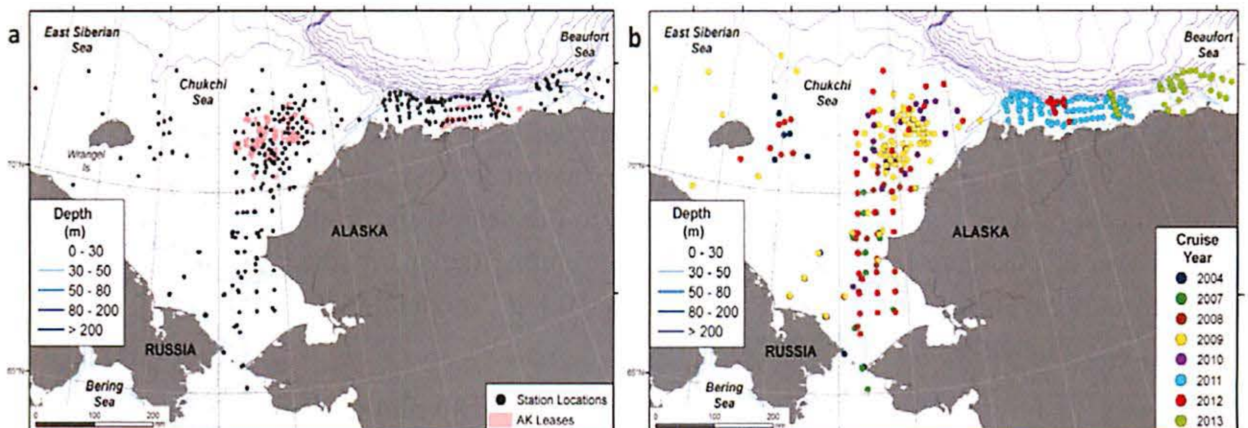

Figure 2. Station coverage for snow crab in the Chukchi and Beaufort Seas, (a) in relation to the active leases up through Sale 193 (as per BOEM website, September 2014) (b) color-coded by survey year. (Note that symbols of locations of the 2008 Western Beaufort Survey used for the trophic ecology objective are underneath 2011 stations west of ~150°W).

Environmental variables including water depth, bottom water temperature, and bottom water salinity, were collected during all surveys, by collaborating research teams and/or the principal investigators. As a standard procedure, bottom water temperature and salinity were obtained from CTD casts at each sampling station as part of hydrographical surveys.

Laboratory methods

All snow crabs from trawl catches were rinsed and counted, and bulk wet weight per station was recorded using spring scales or digital hanging scales. Body size, as maximum carapace width (CW) to the nearest 0.1 mm using vernier calipers (as described by Jadamec et al. 1999), was measured from all collected crabs either on deck or in the home lab. Preserved (2009 RUSALCA samples only, 10% formalin-seawater) or fresh crabs were dry blotted, and wet weight of individuals was recorded to the nearest 0.1 g. No correction was applied to formalin-preserved crab weight from RUSALCA 2009; all other crabs were processed fresh or after freezing. For all males, the right chela height was measured to determine their morphometric maturity by means of chela allometry (Conan and Comeau 1986). For all sampled females, maturity was recorded based on the presence of a mature-shaped abdominal flap (flap covers entire ventral side in mature females; Paul et al. 1997). Shell condition, a relative index of shell age as determined for Bering Sea snow crabs, was categorically classified for all crabs as molting, soft shell, recently molted/new shell, old shell, very old, and very very old shell (according to Jadamec et al. 1999 and as updated by Stichert 2009).

Fecundity was estimated from egg clutches of 322 mature females (Figure 3b) using egg counts and weights. From a total egg clutch removed from the pleopods, 250 eggs were subsampled, dried at 60°C until a constant weight was reached, and dry weight determined (Paul et al. 1997, Stichert 2009). The remaining eggs were dried in the same fashion for total dry weight (Figure 3c). Egg developmental stage was determined in three categories (stage 1–4; stage 5–9; stage >9) by yolk amount (after Moriyasu and Lanteigne 1998) and by the presence of eye spots in a subset of clutches (n=268) based on a photographic guide by J. Webb (ADF&G Juneau). Clutch fullness as a measure of reproductive success was determined categorically according to Jadamec et al. (1999) and updated by the Alaska Department of Fish and Game (ADF&G) and the National Marine Fisheries Service (NMFS). Spermathecae were removed (Figure 3d) and the spermathecal content was taken out and weighed to the nearest mg from n=195 mature females. The number of ejaculate layers was recorded after cutting the spermathecae in half. In addition, the spermathecal load was classified 'low' from ≤0.1 g, 'moderate' from 0.2–0.5 g, and large ≥ 0.6 g, after Sainte-Marie et al. (2002).

For dietary analyses, 360 crabs collected 2011–2013 (30–130 mm CW) were dissected (Figure 3e), and stomach contents removed. Items were studied under a dissecting microscope (Leica M165) outfitted with a camera (Leica DFC420), and each prey item was identified to the lowest taxonomic category possible and photo-cataloged. Frequency of occurrence of individual food items was determined. Enumerating or weighing prey items was not possible because crab gastric mills (Figure 3f) efficiently grind prey items into many small pieces (Figure 3g).

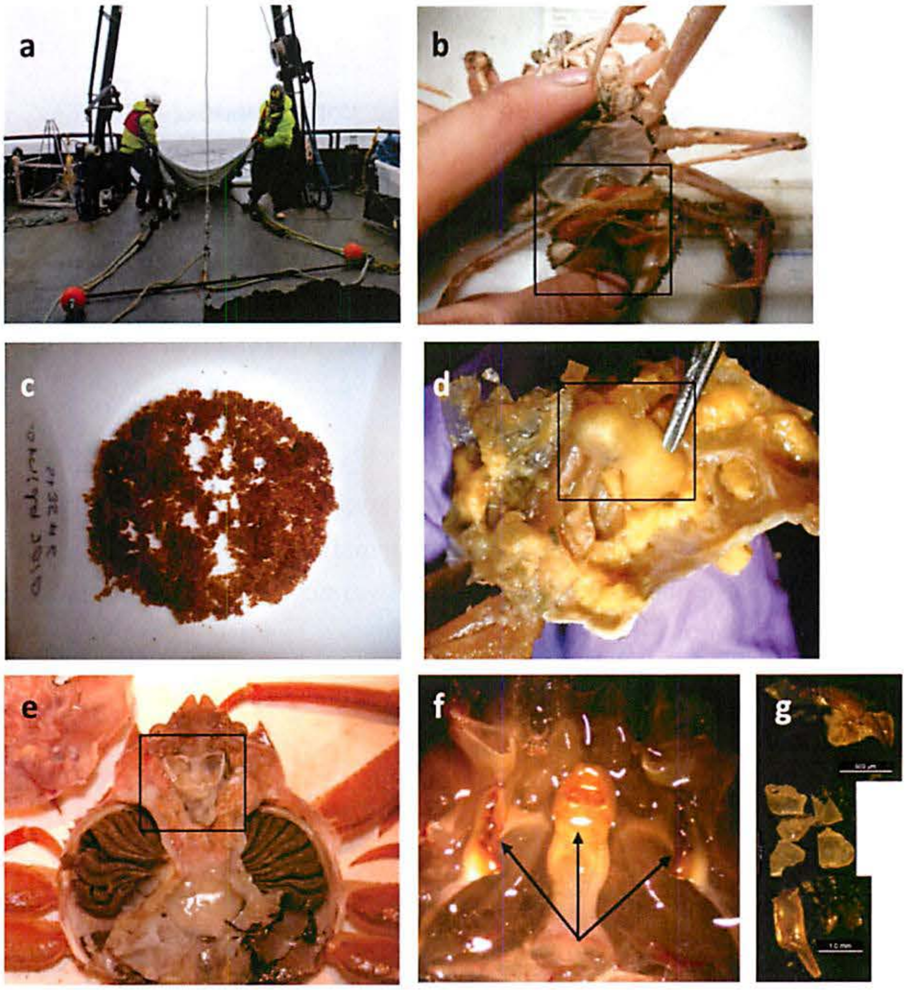

Figure 3. Illustrations of methods applied. (a) Standardized plump-staff beam trawl used for most crab collections, (b) determination of clutch size in mature female crab with clutch, (c) quantification of number and weight of eggs to estimate fecundity, (d) dissection of spermathecal (marked by black box) to determine sperm reserves in female snow crab for potential subsequent clutch production, (e) dissection of stomach (black box) to identify prey composition, (f) gastric mill that crushes prey items, (g) identification of prey item pieces.

In most cases, the same crabs studied for stomach contents were also used for stable carbon and nitrogen analysis. Muscle tissue samples were dissected from crab legs and kept frozen at -20°C before drying at 60°C. Lipids were removed from crab muscle tissue to avoid bias in carbon signatures from isotopically lighter lipids. Water column particulate organic matter was analyzed as the food web baseline reference for determining trophic level. For this, water collected from the CTD rosette was filtered onto pre-combusted GF/F filters, dried at 60°C and HCl-fumed prior to analysis to remove inorganic carbonates. Samples were measured at the Alaska Stable Isotope Facility at the University of Alaska Fairbanks on a Thermo Finnigan Delta Isotope Ratio Mass-Spectrometer with Pee Dee Belemnite and atmospheric nitrogen as standards for carbon and nitrogen, respectively (as in Iken et al. 2010). Sample isotopic ratios are expressed in the conventional δ notation as parts per thousand according to the following equation:

$$\delta X = [(R_{sample}/R_{standard}) - 1] \cdot 1000$$

where X is ^{13}C or ^{15}N of the sample and R is the corresponding ratio $^{13}C/^{12}C$ or $^{15}N/^{14}N$. Analytical instrument error typically is ~ 0.1% for ^{13}C and 0.2% for ^{15}N.

To ensure compatibility of our lab methods with those routinely used by NMFS and the ADF&G for their Aleutians Islands and eastern Bering Sea crab surveys, we visited the ADF&G office and laboratories in Kodiak at the beginning of this project. Laura Stichert, an ADF&G snow and tanner crab biologist who conducts a major part of the reproductive studies for the agencies, provided training and feedback.

Analytical approach

Biomass and abundance were estimated from area swept (= net swath x distance towed) and counts and weights collected at sea, and were normalized to 1000 m^{-2}. Spatial patterns in abundance and biomass were produced using ArcGIS version 9.1 with support by Alynne Bayard at the University of Maryland.

A size-frequency distribution (SFD) histogram was established from all size data available across years to characterize the size range of immature and mature females and males. Given the absence of any obvious modes, a typical problem for slow-growing, high latitude crustaceans (Sainte-Marie et al. 1995, Bluhm and Brey 2001, Shirley and Bluhm 2005), we did not attempt to separate instars. Rather, we used the SFD to identify regional-scale distribution patterns for 2009, the year with the largest sample size.

Fecundity in mature females was determined by dividing the dry weight of the total egg mass by the average dry weight of the eggs in the subsample. The relationship of both the number of eggs and sperm reserves with various variables was tested using Pearson rank correlations. Size-at-maturity is given as the size where 50% of all females were mature (Jewett 1981).

Diets were analyzed for differences within and among regions, size classes (in 10 mm increments), and sex classes using permutational multivariate analysis of variance (PERMANOVA). Regions were bounded as follows: southern Chukchi (66.05 to 70.00 °N, -164.14 to -168.50 °W, n=106), northern Chukchi (70.50 to 73.00 °N, -157.18 to -168.51 °W, n=115), western Beaufort (70.50 to 71.30 °N, -147.28 to -151.34 °W, n=37), central Beaufort (70.10 to 70.90 °N, -144.95 to -147.07 °W, n=72), and (for diet studies only) Canadian Beaufort (69.93 to 71.33 °N, -123.49 to -140.40 °W, n=30) (Figure 4). Crab size ranges included by region: southern Chukchi Sea 40.2–89.2 mm CW; northern Chukchi Sea 40.1–88.5 mm CW; western Beaufort Sea 32.6–75.8 mm CW; central Beaufort Sea 50.5–129.6 mm CW; Canadian Beaufort Sea 80.0–130.0 mm CW. Regional differences in snow crab $\delta^{13}C$ and $\delta^{15}N$ stable isotope signatures were tested using PERMANOVA with post-hoc tests within each region to test whether sex had significant effects on isotope values.

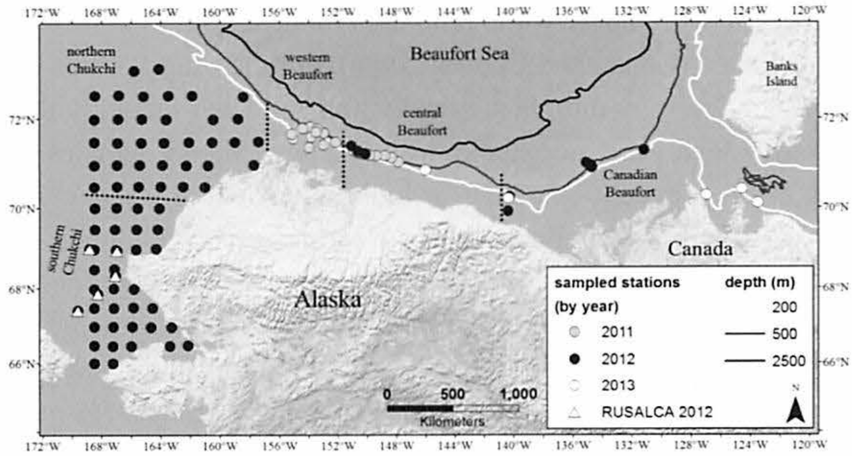

Figure 4. Regions (delineated by dotted lines) and station locations for stomach content and stable isotope sampling.

Results

Crab distribution and population structure

The combined 2004–2013 data showed that *Chionoecetes opilio* occurs across the entire Chukchi Sea up to Wrangel Island and into the East Siberian Sea in the west and into Barrow Canyon in the east. In both the western and the eastern Chukchi Sea, the distribution extended to at least 73°N (Figure 5a,b). Most Chukchi Sea stations were shallower than 70 m, but crabs were also found at the few stations >100 m. In the Beaufort Sea, crabs occurred on the western shelf and along the upper continental slope to ~500 m in the western and central Beaufort Sea (Figure 5a,b). No *C. opilio* were found at stations shallower than 26 m and east of 146.08° W in the surveys considered in this study. The few crabs found during the Transboundary cruise in the Beaufort Sea in 2013 extended the documented range of snow crab in U.S. waters eastward. It is noteworthy, however, that we found a few small specimens at 19 m in the central Beaufort Sea in the 2014 ANIMIDA III survey, and one large snow crab at 140° W (near the U.S.– Canadian border) during the Transboundary 2014 survey. Interestingly, three blue king crab specimens were also found at depths of 180 m in the western Beaufort Sea during the 2011 survey. These, and a blue king crab caught in 2008 are the first recorded for the area to our knowledge.

The combined data set revealed insights into the spatial and depth distribution of male, female and juvenile crabs (Figures 6, 7). Juvenile crabs (~5–16 mm CW) were primarily encountered in the southern Chukchi in 2012 between 30–60 m depth, although some were encountered as far north as Herald Canyon (Figures 6b, 7a). Immature female crabs and male crabs were found throughout the locations sampled, and mature females were absent from Bering Strait. Immature females occurred throughout the depth range sampled on the Chukchi shelf (~30–150 m), and in the Beaufort Sea shallower than 200 m. Large males only occurred deeper than 180 m, and were restricted to the Beaufort Sea shelf break and slope (Figure 7b).

Applying the chela height to carapace width ratio used to identify morphometrically mature male *C. opilio* in the Bering Sea (Conan and Comeau 1986), our data suggest that all measured male crabs from the Chukchi Sea were morphometrically immature and that only the males in deeper waters on the Beaufort slope were morphometrically mature. Mature females were concentrated on the central part of the Chukchi Sea shelf including the Central Channel (Figure 6b). Their body size varied widely across the region with no clear pattern with latitude (Figure 7d). In the Beaufort Sea, very few mature females were caught, and those were only found deeper than 160 m on the upper slope (with one exception) (Figures 6b, 7a). Averaged across the Chukchi Sea, 54% of the crabs were males, 14% mature females, and 32% immature females. In the Beaufort Sea, the sex ratio was strongly skewed towards males with 82% males, 7% mature females, and 11% immature females.

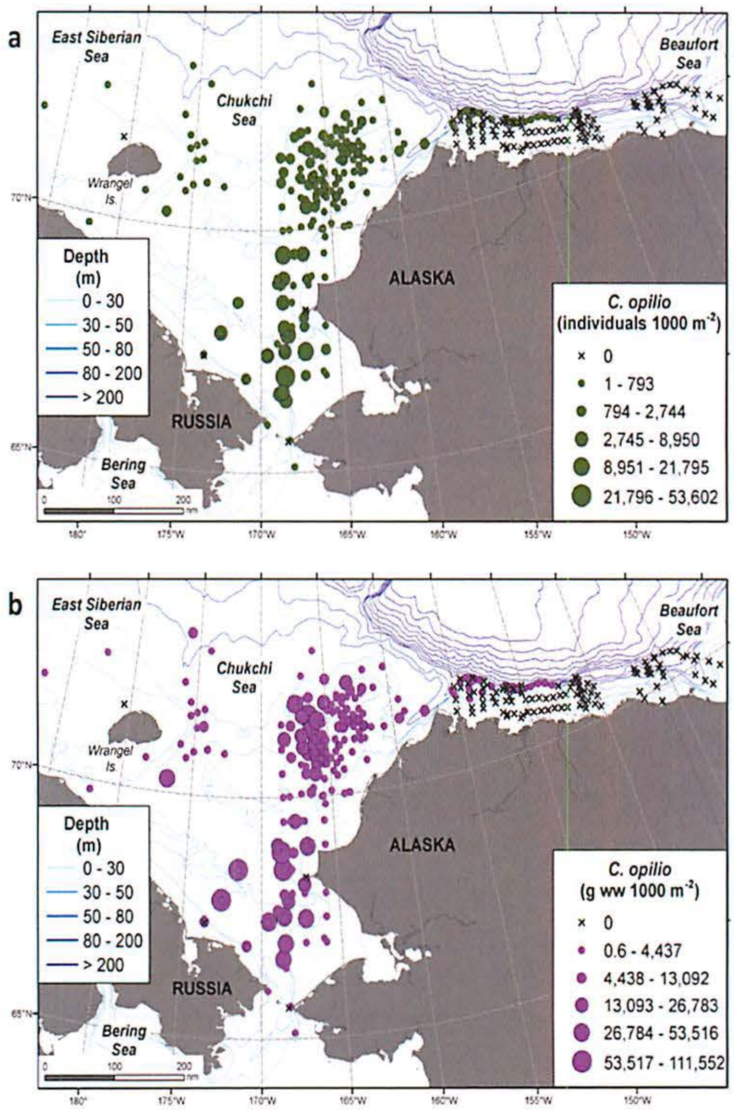

Figure 5. Abundance and biomass estimates of snow crabs in the Chukchi and Beaufort Seas, standardized to individuals per 1000 m^2 based on 2-10 min plump-staff beam trawl hauls taken at ~1.5 kn speed with 4 mm mesh in the cod end). (a) Abundance and (b) biomass for all sampling years combined.

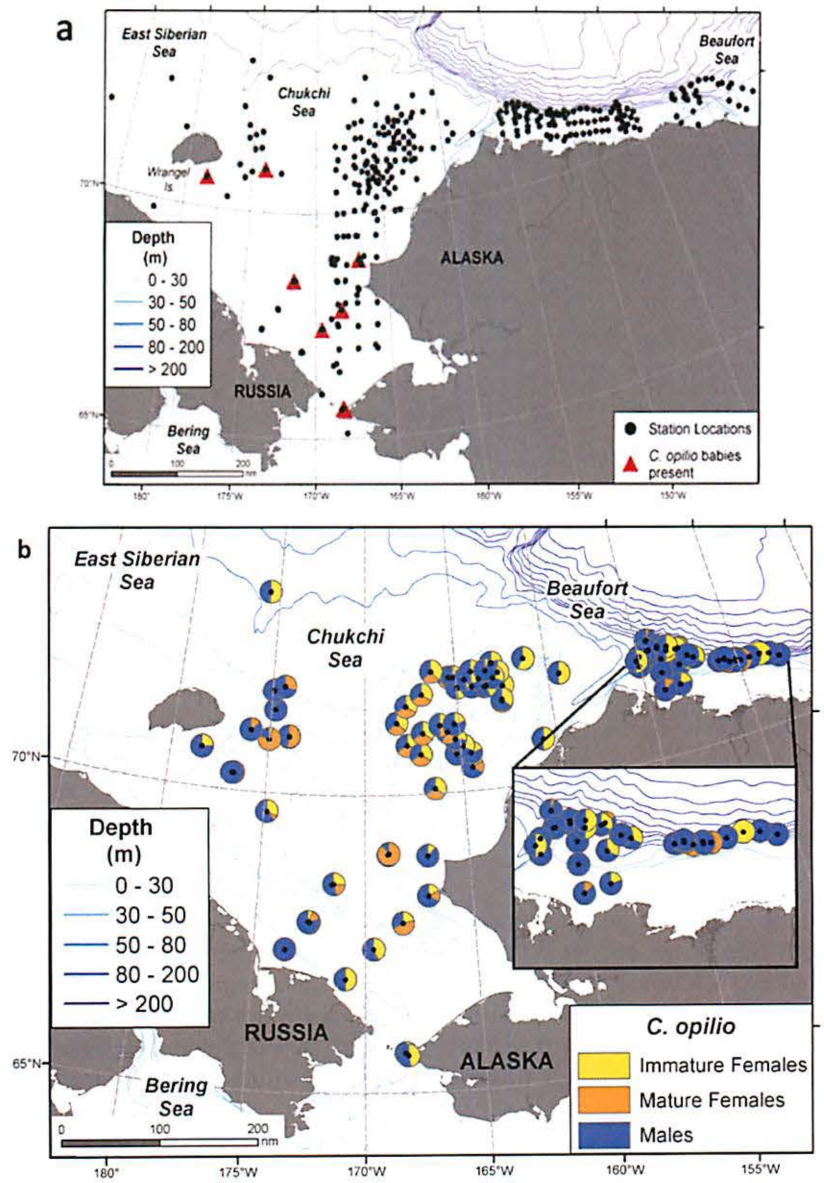

Figure 6. Distributions of snow crab sexes and maturity stages. (a) Locations where juvenile crabs were found. (b) Spatial distribution of proportions of immature and mature females and males across the study area for all years.

When applying the chela height to carapace width relationship used to identify morphometrically mature male *C. opilio* in the Bering Sea (Conan and Comeau 1986; Figure 7c), these large males in deeper waters on the Beaufort slope would be considered morphometrically mature, while all measured male crabs from the Chukchi Sea would be classified morphometrically immature. Mature females were concentrated on the central part of the Chukchi Sea shelf including the Central Channel (Figure 6b). Their body size varied widely across the region with no clear pattern with latitude (Figure 7d). In the Beaufort Sea, very few mature females were caught, and those were only found deeper than 160 m on the upper slope (with one exception) (Figures 6b, 7a). Averaged across the Chukchi Sea, 54% of the crabs were males, 14% mature females, and 32% immature females. In the Beaufort Sea, the sex ratio was strongly skewed towards males with 82% males, 7% mature females, and 11% immature females

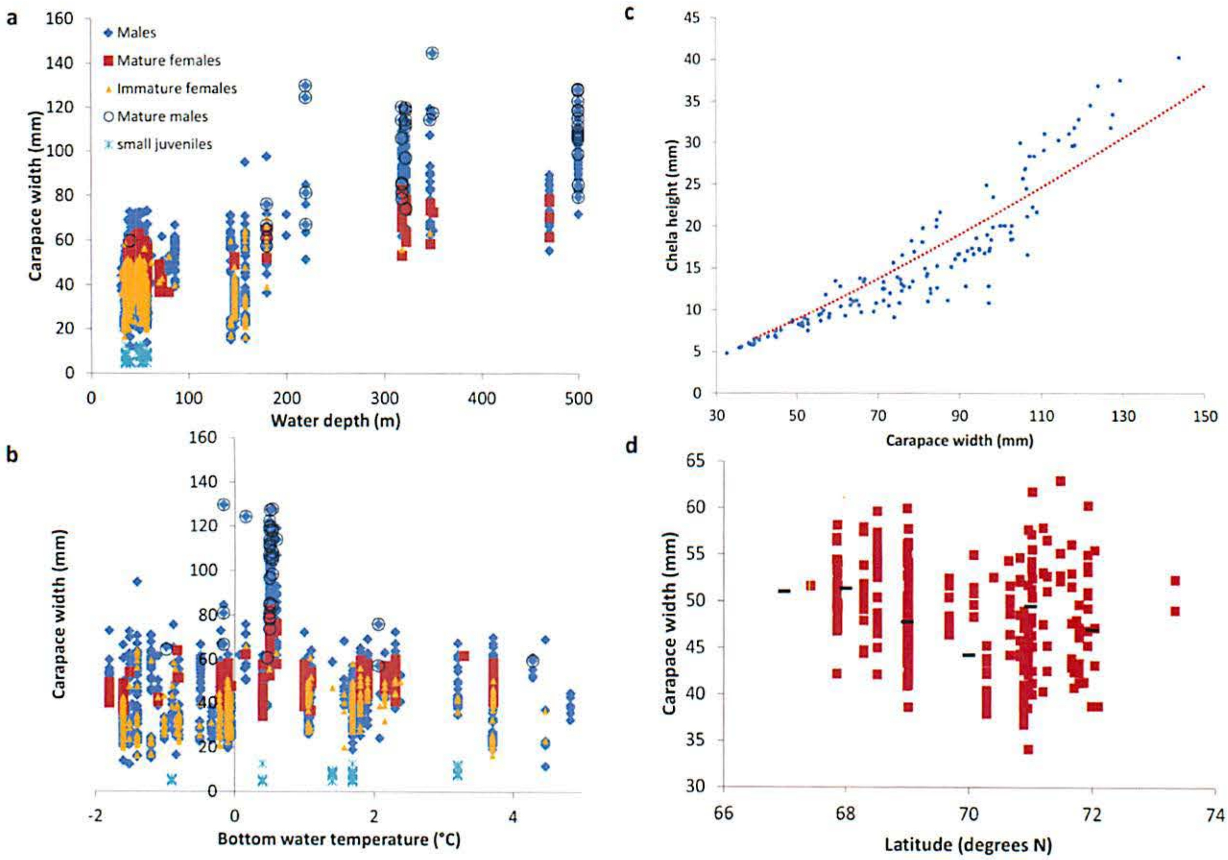

Figure 7. Distribution of body sizes for snow crabs from the Chukchi and Alaska Beaufort Seas; (a) in relation to water depth and (b) in relation to bottom water temperature. Males classified morphometrically mature in this fashion are symbolized as such in (a). (c) Separation of mature male crabs (above red line) and immature males crabs (below red line) based on the ratio of chela height to carapace width applicable in eastern Bering Sea and east Canadian crabs. Note: it not clear whether this line is biologically meaningful in the Chukchi and Beaufort Seas. (d) Mature female body size in relation to latitude with black symbols showing means per degree latitude.

Crabs caught in the PSBT ranged in size from 4–144 mm CW (Figure 8). Morphometric measurements revealed that snow crabs in the Chukchi Sea were overall smaller than those from the Beaufort Sea (Figure 8a,b). The majority of male Chukchi Sea crabs were smaller than 65 mm CW (Figure 8a), most immature females measured between 30 and 45 mm CW, and the majority of mature females fell into the range of 40–55 mm CW. For the Chukchi Sea, this pattern appeared to be fairly consistent across the region, as shown by the consistent patterns in subregion-specific size-frequency distributions from 2009, the year with the largest sample size (Figure 9). In contrast, a larger range of crab sizes occurred in the Beaufort Sea and 29% were at Bering Sea fishery legal size (78 mm CW) or larger. Very small crabs were not found in the Beaufort Sea during the 2008–2013 surveys considered here. As noted above, however, four crabs <12 mm CW were sampled during the 2014 ANIMIDA III survey.

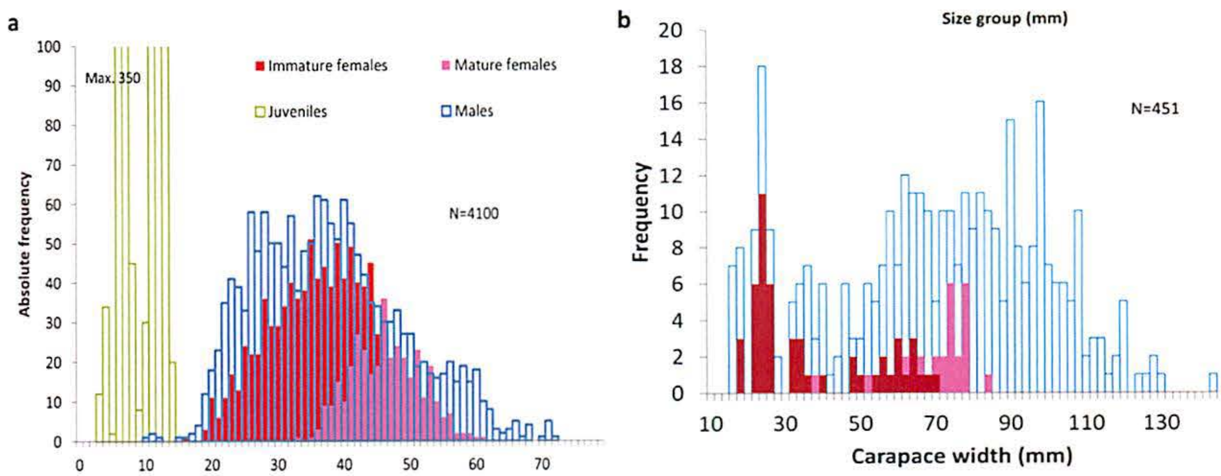

Figure 8. Size-frequency-distribution of snow crabs caught in the (a) Chukchi Sea and (b) Alaska Beaufort Sea across all sampling years. Note the larger sizes in the Beaufort Sea.

Abundance and biomass

Mean snow crab abundance across all sampling years was 1073 ind 1000 m^{-2} for the Chukchi Sea and only 1.7 ind 1000^{-2} in the Beaufort Sea. Mean abundance was almost 8-fold higher in the southern versus the northern Chukchi Sea (Figure 5a). Similarly, mean abundance was >10-fold higher in the western than the central Beaufort Sea, and 5-fold higher on the Beaufort slope (>100 m) than the shelf. When 2009 and 2012 records were mapped separately, variability in abundance between years became obvious (Figure 9c,d). In 2012, the asymmetry between high abundance in the southern Chukchi Sea and lower abundance in the northern Chukchi Sea was particularly striking (Figure 9d). This asymmetry was driven in part by high numbers of juvenile occurring at a few sites in the southern Chukchi that added to the high abundance there.

Mean biomass across all sampling years was 6803 g ww 1000 m^{-2} for the Chukchi Sea and 273 g ww 1000 m^{-2} for the Beaufort Sea. Biomass was 2.4-fold higher in the southern than the northern Chukchi Sea, 10-fold higher in the western than the central Beaufort Sea, and 21-fold higher on the Beaufort slope than the shelf (Figure 5b). Combined, the relationships in abundance and biomass suggested that crabs were, on average, larger in the northern than the southern Chukchi Sea (maybe partially driven by the small, juvenile crabs that were abundant in the southern Chukchi), and also larger on average on the Beaufort slope compared to the shelf (see also Figures 10, 11). As with abundance, biomass patterns mapped separately for 2009 and 2012 revealed interannual variability both in absolute magnitude and distributional pattern of snow crab biomass (Figure 9e,f). Crab biomass was highest at depths below 100 m, at temperatures between -2 and +3°C and at salinities of 32 to 33.4 (Figure 12).

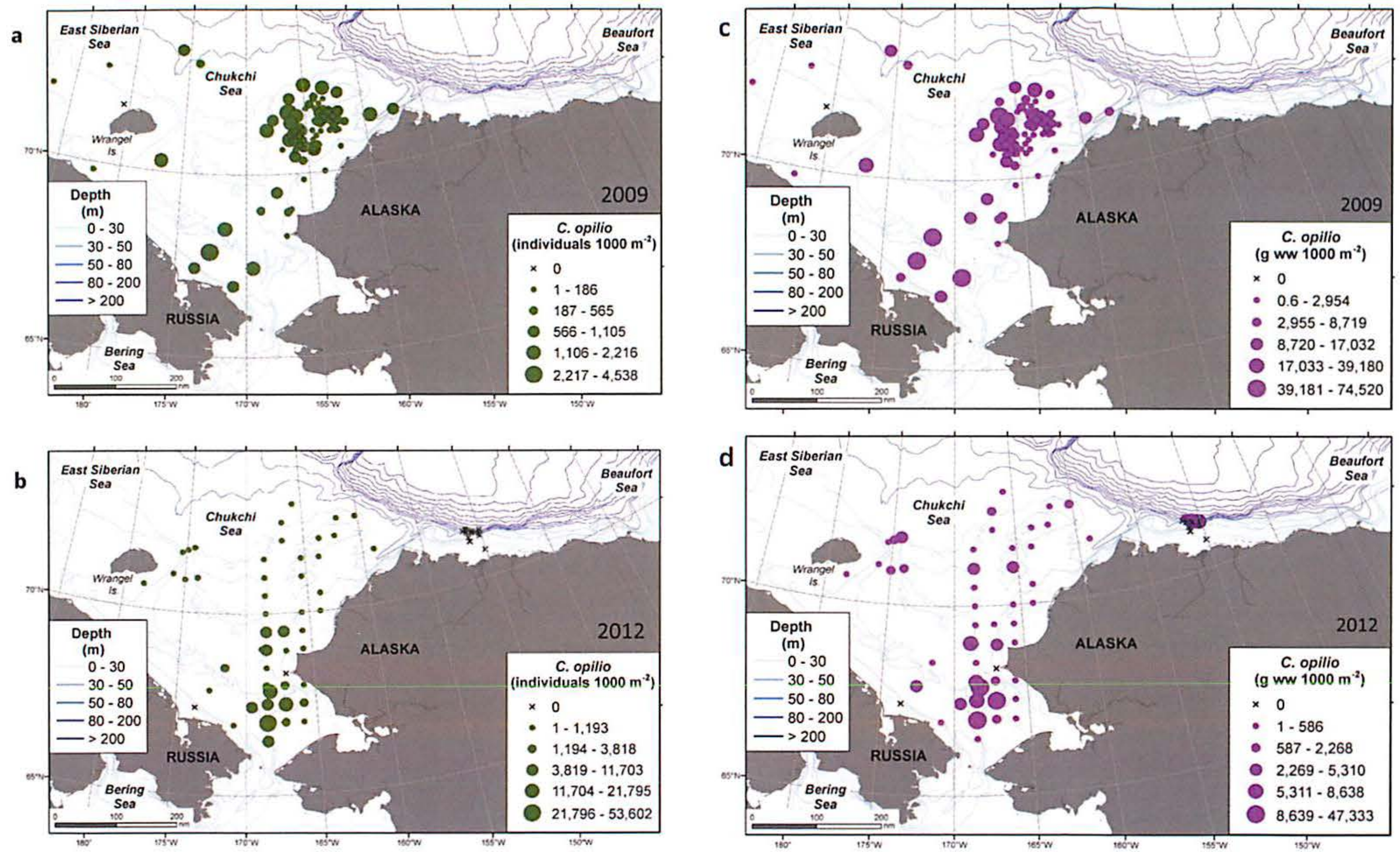

Figure 9. Abundance and biomass estimates of snow crabs in the Chukchi and Beaufort Seas, standardized to individuals per 1000 m^2 based on 2–10 min plumb-staff beam trawl hauls taken at ~1.5 kn speed with 4 mm mesh in the cod end). (a) Abundance in 2009, (b) abundance in 2012, (c) biomass in 2009, (d) biomass in 2012. 2009 and 2012 were the two years with the most extensive sampling coverage.

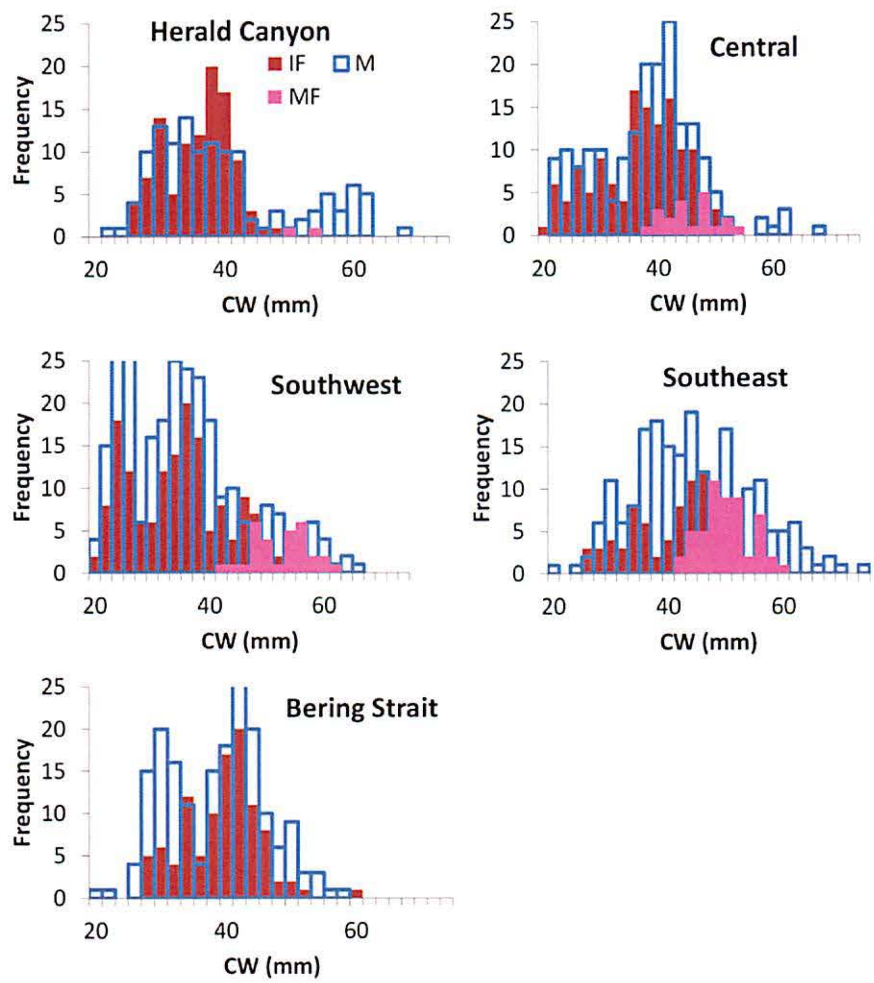

Figure 10. Regional distribution of size-frequencies of snow crabs caught in the Chukchi Sea in 2009, the year for which most data were available.

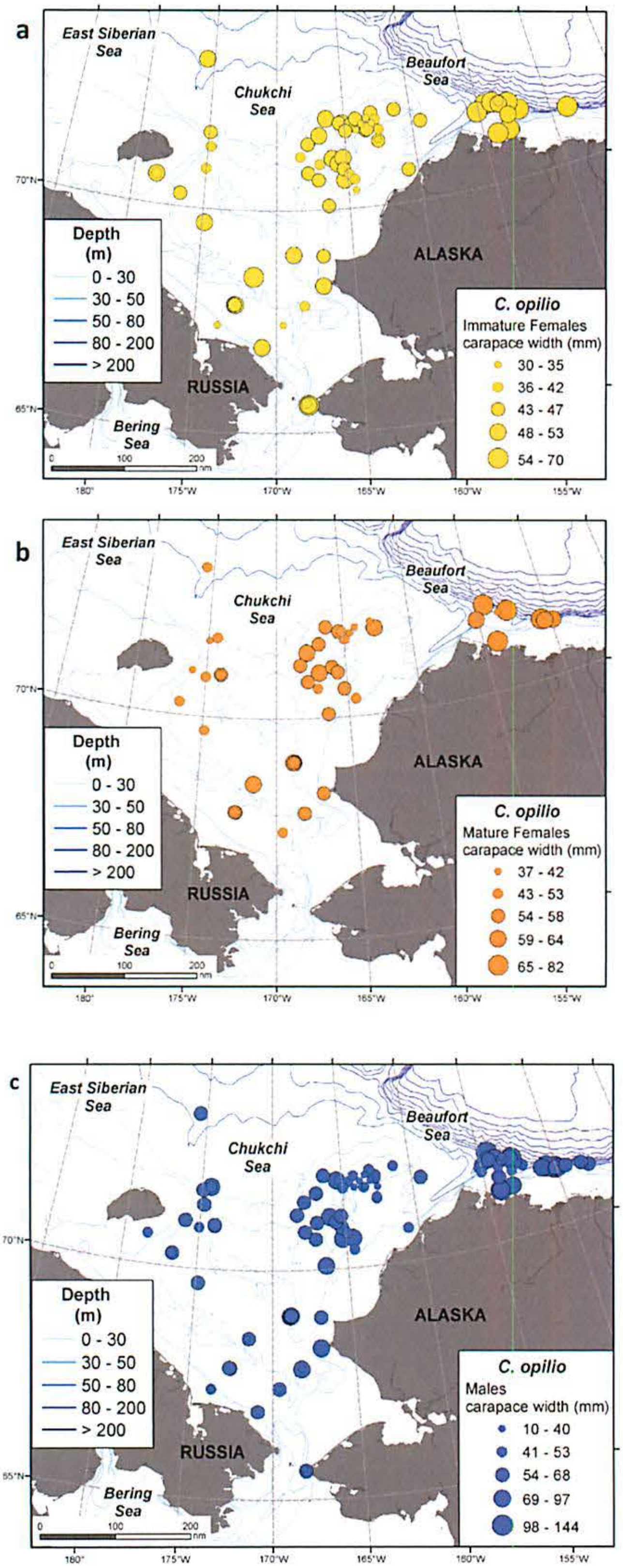

Figure 11. Maximum body size (as carapace width) of snow crab in the Chukchi and Alaska Beaufort Seas for (a) immature females, (b) mature females, and (c) males. Crabs from all sampling years were combined.

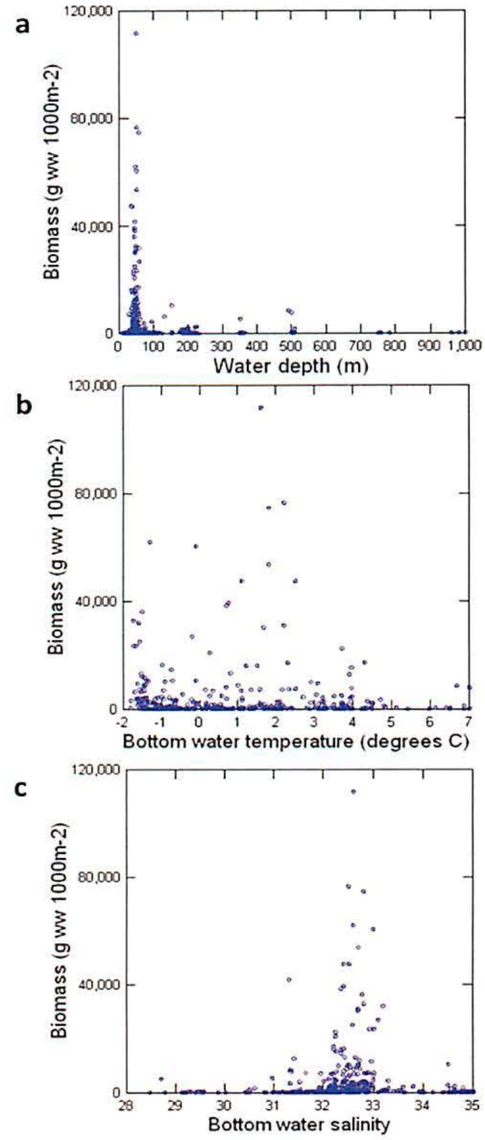

Figure 12. Biomass relationships of snow crab in the Chukchi and Alaska Beaufort Seas to (a) water depth, (b) bottom water temperature and (c) bottom water salinity.

Reproductive potential

Female fecundity ranged from <5,000 to >50,000 eggs per female over a female crab size range of 36–72 mm CW. Most females had full clutches, corresponding to clutch fullness indices 5 and 6. The Pearson correlation coefficient for the number of eggs per female versus carapace width was r=0.69, confirming that female fecundity scales with body size as it does in other regions (Figure 13a). The low correlation coefficients for relationships between fecundity and water depth, bottom water temperature, and latitude (all r<0.30) suggest that those factors have less direct influence on female fecundity (Figure 13b-d). The eggs were in early developmental stages (combined stages 1–4) in 84% of the mature females investigated, while 15% were in later developmental stages with reduced yolk amounts (combined stages 5–9), and 1% were in late stages with pigmented eyes visible (combined stages 11–12).

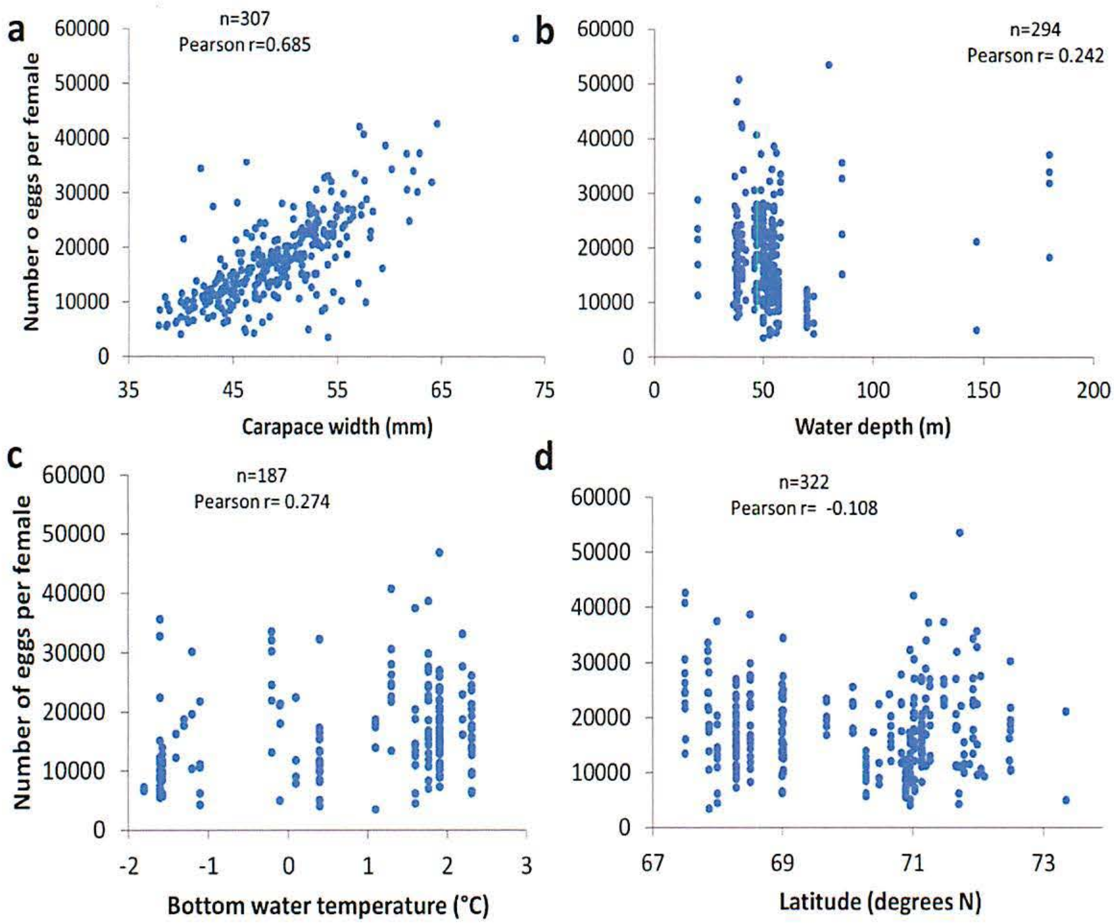

Figure 13. Fecundity as number of eggs per mature female snow crab from the Chukchi Sea plotted against (a) body size, (b) water depth, (c) bottom water temperature, and (d) latitude. The only strong relationship was with carapace width.

About 77% of all mature females were new shell crabs (shell condition 2; Figure 14a), which in the southeastern Bering Sea and Canadian Atlantic is interpreted as being primiparous (i.e., carrying the first clutch; Sainte-Marie et al. 2008). About 16% of the mature females were classified as shell condition 3 (old shell), and 7% as condition 4 (very old shell). These shell condition indices are considered multiparous crabs in the Bering Sea (i.e., carrying subsequent clutches; see Sainte-Marie et al. 2008). We caution, however, that the shell condition criteria and interpretation of primiparous versus multiparous were developed for Bering Sea and Canadian Atlantic crabs, and may not be applicable to Arctic crabs. For Chukchi Sea crabs, we estimated that 50% of female snow crabs in the Chukchi Sea reach maturity at 46 mm carapace width (Figure 14b). We caught very few mature snow crab females from the Beaufort Sea and cannot provide an estimate of size-at-maturity for that region.

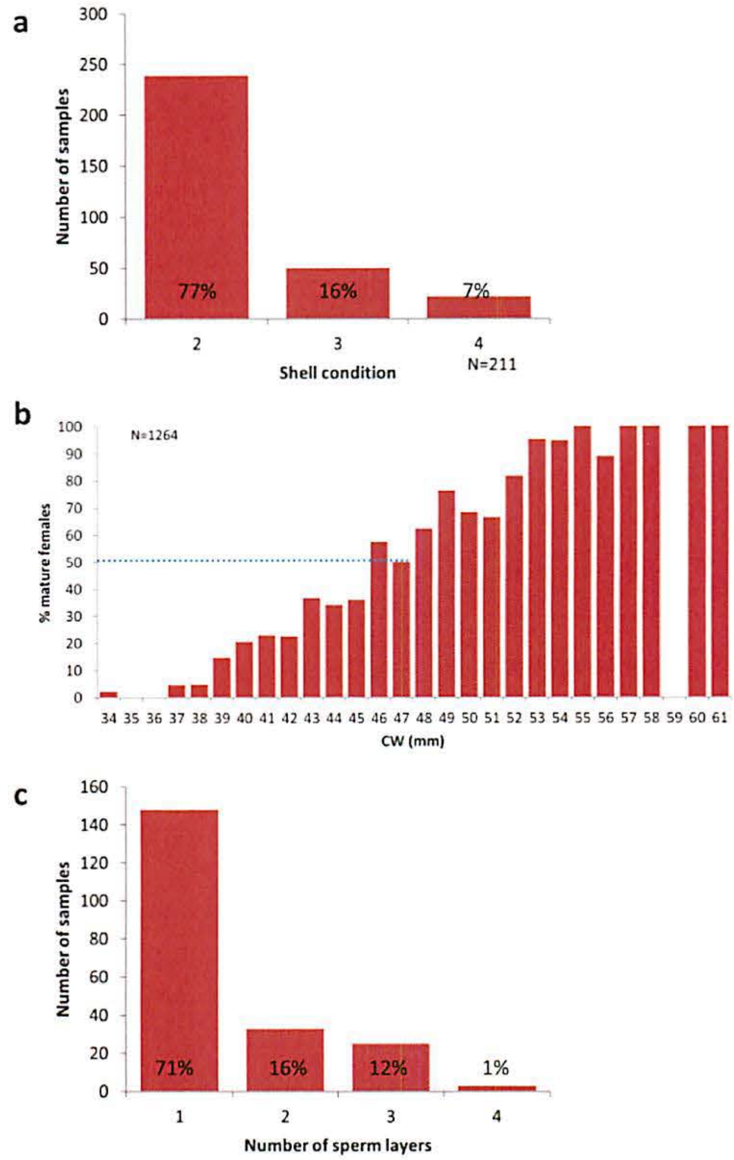

Figure 14. Female reproductive characteristics. (a) Distribution of mature, egg-bearing females in terms of shell condition index. (b) Size at which 50% of female snow crabs in the Chukchi Sea were mature = 46 mm carapace width. (c) Number of sperm layers in spermathecae.

Spermathecal load measured as weight of the sperm stored in the left spermatheca in female crabs ranged from 0.001 to 0.240 g, and loads were classified as 'low' to 'moderate' by Sainte-Marie et al. (1996). Most of the loads were 'low' (0.025±0.032 g) and were neither related to female body weight, nor to shell condition or water depth (Figure 15). The number of sperm layers ranged from 1–4 with the majority (71%) of mature females having only one layer in their spermathecae (Figure 14b).

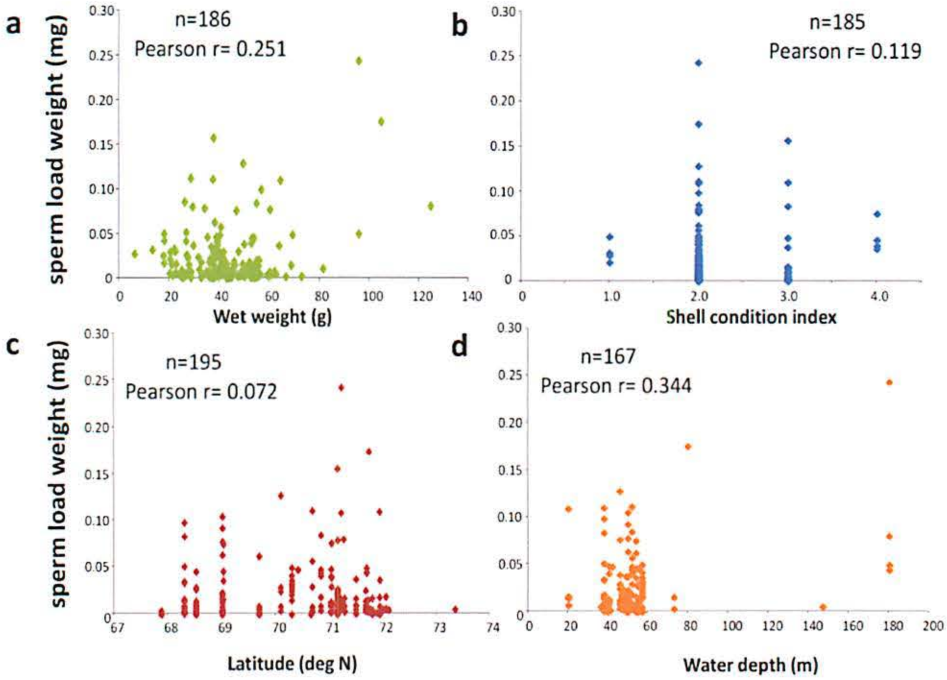

Figure 15. Sperm reserves (as weight of sperm load in the left spermathecal) in mature females from the Chukchi Sea, plotted against (a) body weight, (b), shell condition index, (c) latitude and (d) water depth. None of the relationships was particularly strong.

Trophic characterization

Crab stomach fullness and diet composition ranged widely and varied regionally. Stomach fullness ranged from 0–70%. Snow crabs consumed four main prey taxa: polychaetes, decapod crustaceans (crabs, amphipods), echinoderms (mainly ophiuroids), and mollusks (bivalves, gastropods) (Figure 16a). Polychaetes and bivalves were more common than ophiuroids, amphipods, decapods, and fishes. Both stomach contents and stable isotope values revealed regional differences. Crab diets in the two Chukchi regions were similar to those in the western Beaufort (highest bivalve, amphipod, and crustacean consumption) (Figure 16a, Table 2). The Canadian Beaufort region was most unique in prey composition and stable isotope values. Crab diets in the Canadian Beaufort Sea were different from all other regions due to apparent dominance of 'other polychaetes', but this result may be somewhat biased by the limited crab size range available from that region (all > 80 mm CW; Figure 16b). Regional differences were most conspicuous for polychaetes, which were more common in the central and Canadian Beaufort than the western Beaufort and Chukchi seas, and for bivalves, which were more common in both Chukchi regions and the western Beaufort than the other two Beaufort regions (Figure 16a). Cannibalism on small snow crabs was higher in the Chukchi regions relative to the Beaufort regions.

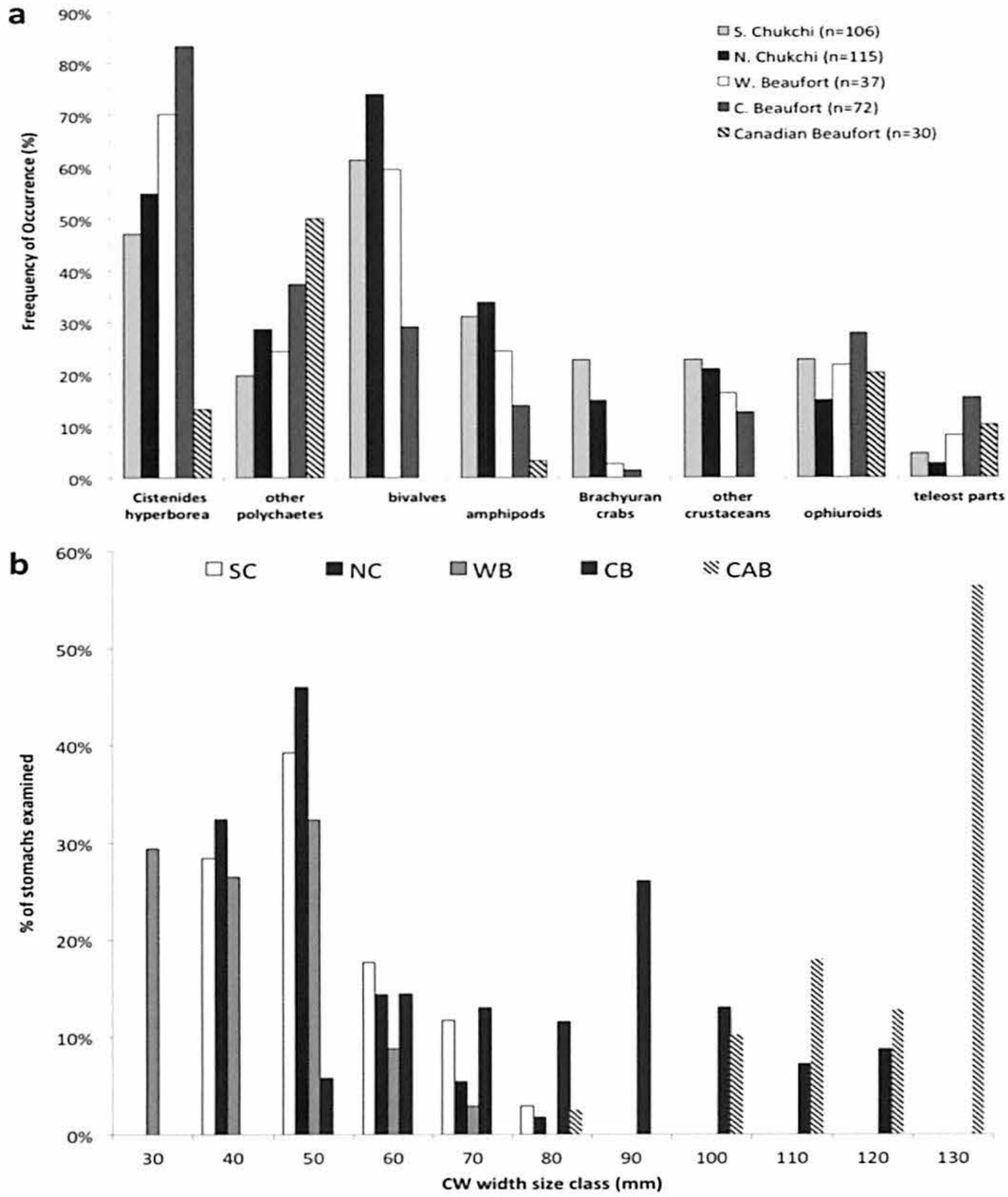

Figure 16. (a) Frequency of occurrence of dominant diet items in snow crabs from the Chukchi and Beaufort Seas. (b) Body size of crabs used to determine stomach contents. Note that the legend is different between (a) and (b).

Table 2. Statistics on the differences in stomach contents of snow crab between regions: PERMANOVA post-hoc pairwise comparisons for regional snow crab diet composition using frequency of occurrence data. SC= southern Chukchi, NC= northern Chukchi, WB= western Beaufort, CB= central Beaufort, EB= eastern Beaufort. In italics: not significant.

Regional pairwise comparison	t	p-value
WB, CB	1.8826	0.003
WB, SC	1.601	0.014
WB, NC	*1.2744*	*0.131*
WB, EB	2.0243	0.004
CB, SC	2.3721	0.001
CB, NC	2.9254	0.001
CB, EB	1.6865	0.011
SC, NC	1.6605	0.004
SC, EB	1.6538	0.009
NC, EB	2.2557	0.001

We also observed a trend of decreasing carbon stable isotopes in crabs from the Chukchi to those in the Canadian Beaufort, with the central and Canadian Beaufort crabs having the lowest $\delta^{13}C$ values (Figure 17; Appendix 3), likely reflecting the increasing use of terrestrial carbon sources towards the eastern regions of the Beaufort Sea from Mackenzie River influx. Similarity between the northern Chukchi and the western Beaufort Seas may reflect the high advective connectivity between these two regions, located between the productive Bering Sea Anadyr water to the south and the less productive Beaufort regions to the east.

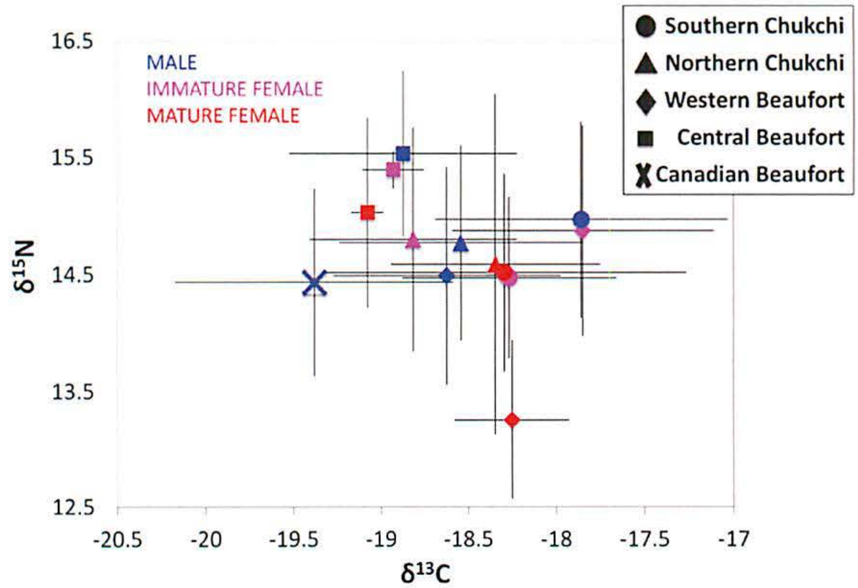

Figure 17. Trophic position of snow crab as indicated by $\delta^{15}N$ versus $\delta^{13}C$ values, shown separately for immature and mature females and males from five subregions.

Prey composition only varied with crab size in some size classes in the southern Chukchi and central Beaufort, while stable isotope results showed no size-dependent differences (Table 3). Slightly, although statistically significantly higher mean carbon isotope values for males in the southern Chukchi (Appendix 3) may not be reflective of a gender-specific pattern but rather be driven by low sample size. Mean $\delta^{15}N$ values of region-sex groups were generally similar (primarily within <1‰). Male crabs overall had higher $\delta^{15}N$ values than females from the same region (although this difference was not obvious in the diet composition) (Fig. 17).

Table 3. Comparison of results from stomach content analysis (SCA) and stable isotope analysis (SIA) using PERMANOVA. Comparisons were done for different size classes and sex classes nested within study regions in the Chukchi and Beaufort Seas. Results shown indicate variance components explained by region and body size, F-statistics, and significance.

Source of variation	**df**	**SS**	**MS**	**Pseudo - F**	**P (based on 999 permutations)**
SCA- Region, Sex, size class as fixed variables					
Among regions	3	20333	6777.7	2.8	**0.001**
Region*size class	13	42935	3302.7	1.4	**0.002**
SCA- size class nested within region					
Among regions	4	57218	14304	5	**0.001**
Region (size class)	23	76203	3313.2	1.4	**0.002**
SCA- post-hoc pairwise regions					
southern Chukchi- northern Chukchi					0.208
southern Chukchi- western Beaufort					0.281
southern Chukchi- central Beaufort					**0.001**
southern Chukchi- Canadian Beaufort					**0.025**
northern Chukchi- western Beaufort					0.338
northern Chukchi- central Beaufort					**0.001**
northern Chukchi- Canadian Beaufort					**0.008**
western Beaufort- central Beaufort					0.655
western Beaufort- Canadian Beaufort					**0.013**
central Beaufort- Canadian Beaufort					**0.001**
SCA- size class within Individual region					
southern Chukchi	4	24572	6143.1	2.2	**0.001**
northern Chukchi	4	10109	2527.4	1	0.473
central Beaufort	7	21653	3093.3	1.7	**0.007**
western Beaufort	4	9717.5	2429.4	1.1	0.305
Canadian Beaufort	4	10150	2537.6	0.8	0.656
SIA- Region, Sex, size class as fixed variables					
Among regions	3	0.1	0.05	2.1	0.07
Size class	9	0.1	0.01	0.7	0.72
Sex classes	1	0.1	0.1	4.7	**0.03**
Region*size class	14	0.2	0.02	0.8	0.65
Region*Sex	5	0.1	0.03	1.3	0.22
Sex*size class	6	0.1	0.01	0.4	0.93
Region*Sex*size class	4	0.1	0.02	0.7	0.66
SIA- Sex class nested within region					
Among regions	4	0.6	0.2	7.1	**0.05**
Region (sex classes)	2	0.2	0.07	3.4	**0.03**

Discussion

This study improved the knowledge of snow crab distribution in the Chukchi and Beaufort Seas. Snow crabs occur throughout the Chukchi Sea and into at least the western part of the East Siberian Sea. Our sampling coverage had a gap in the central part of the Russian Chukchi Sea, but the distribution records around Wrangel Island, and results from predictive modeling based on habitat preferences (Hardy et al. 2011), makes it reasonable to assume that snow crabs also occur in that area. In the Alaska Beaufort Sea, in contrast, the species seems to be restricted to the western and central areas with more and larger crabs on the upper slope than on the shelf. There appears to be a distribution gap in the eastern part of the U.S. Beaufort Sea, but snow crabs occur again in the Canadian Beaufort Sea. Crabs are present in northeastern Chukchi lease areas but essentially absent from current Beaufort lease areas. Where crabs are present, abundances are highest in the southern Chukchi Sea and lowest in the central Beaufort Sea. Biomass patterns vary between years; however, snow crabs contribute substantially to epibenthic biomass throughout the Chukchi Sea and western Beaufort slope, and are among the biomass-dominant epibenthic taxa in some areas (Bluhm et al. 2009, Rand and Logerwell 2011, Ravelo et al. 2014). Crabs were rare in waters less than 30 m (although few shallow sites were sampled) and east of 146° W during the surveys considered here. In the Canadian Beaufort Sea, however, snow crabs were found farther east during BREA cruises between 2012–2014 (A. Majewski and S. McPhee, personal communication), albeit in low numbers (those crabs are included in the diet results in this study). Abundances increase to harvestable levels farther east in western Greenland (Burmeister and Sainte-Marie 2010). Temporal resolution of abundance and biomass data was too sparse to determine potential cyclic patterns (especially in the Beaufort Sea), but variable abundance and biomass across years in the Chukchi Sea suggest interannual variability in standing stock size, as has been documented in the Bering Sea and eastern Canada (Sainte-Marie et al. 1996, Parada et al. 2010).

Regional distribution patterns differed some between males and females and between immature and mature crabs. The differences were most obvious in the Beaufort Sea. Such regional patterns, again, have been documented for the eastern Bering Sea, where large sample sizes and long time series have facilitated in-depth analyses in this regard (Zheng et al. 2001, Ernst et al. 2005). Our more limited data set suggests that mature females appear to be concentrated on the inner (offshore) parts of the Chukchi Sea, where essentially all mature females were egg-bearing. In contrast and somewhat surprising, mature gravid females were almost absent from the adjacent Chirikov Basin just south of Bering Strait in recent years (Kolts et al. 2015). In the 1970s, mature females with eggs were also extremely sparse in the southeastern and the northeastern Chukchi Sea, and the western Beaufort Sea (Jewett 1981, Frost and Lowry 1983). Specifically, less than 5% of mature females from the northeastern Bering and southern Chukchi Seas combined were gravid in 1976 (Wolotira et al. 1977, Jewett 1981) and only a single gravid female from the northeastern Chukchi Sea was found in 1976–1977, and none in the western Beaufort Sea (Frost and Lowry 1983). In contrast, almost all mature females sampled in the 1990s were gravid in the northeastern Chukchi Sea (Paul et al. 1997), as they were in our study.

Slight differences in sampling period relative to the timing of clutch extrusions or a northward shift in of gravid female distribution in the Chukchi Sea could explain these differences in gravid female occurrence in different decades. The occurrence of a few juvenile crabs in the nearshore Mackenzie Shelf area suggests that gravid females may be present in the area, but were not collected. Few mature females occurred in the Beaufort Sea in the 2010s and those found were limited to the shelf break and upper slope and were not gravid.

While all crabs in the Chukchi Sea are small (primarily <60 mm CW), irrespective of maturity status and sex, size-segregation was apparent in the Beaufort Sea. Large male and mature female crabs (>~80 mm CW) occurred exclusively on the Beaufort Sea slope and both sexes were smaller on the adjacent shelf. It is unclear if these larger size classes in the deeper waters are related to ontogenetic migrations from shallower to deeper waters in the Beaufort Sea as is documented for the Bering Sea (Ernst et al. 2005, 2012). However, when applying the chela height to carapace width ratio used to identify morphometrically mature male *C. opilio* in the Bering Sea (Conan and Comeau 1986), our data suggest that all measured male crabs from the Chukchi Sea are morphometrically immature, and that only the males in deeper waters on the Beaufort slope are morphometrically mature. This conclusion seems unlikely given that we found gravid females distributed across the Chukchi Sea, and these would have had to be fertilized. If the absence of mature male crabs on the Chukchi shelf was indeed true, one might speculate that the virtual absence of gravid females in the Chirikov Basin could be explained by their northward migration into the southern Chukchi Sea after fertilization in the Chirikov Basin or even further south, a speculation that would need further investigation. Females found in the Chukchi Sea stored sperm in low to moderate amounts comparable to the Bering Sea and Canadian waters (see Sainte-Marie et al. 1996, Stichert et al. 2013). Whether that amount of sperm storage would be sufficient to produce a subsequent clutch needs further study. One could also speculate that few of the many immature male crabs present in the Chukchi Sea ever grow to morphometric maturity, although we would consider this unlikely given that appropriate habitat conditions (Hardy et al. 2011) and food resources are available. Perhaps the allometric relationship between chela size and carapace size of snow crab needs refinement for the small size range of crabs so prominent in the Chukchi Sea. A study focused on relationships of gonad development in relation to body size in maturing male *C. opilio* from the Chukchi and Beaufort Seas could resolve the question of whether small sized male crabs have mature gonads.

If ontogenetic migration was indeed happening, as the distribution of crabs in the Beaufort Sea suggests and as is documented for the eastern Bering Sea, what would the cues be? Bottom water temperature, in particular, and perhaps water depth, are thought to explain the spatial segregation of mature females in the Bering Sea (Ernst et al. 2005, 2012). In our study area, there was no clear relationship between the distribution of either mature females or males and bottom water temperature or water depth. Male and female crabs essentially occurred across a broad temperature range of close to freezing to about 5°C, but we point out some possible preferences of mature crabs. The majority of mature females were collected at bottom water temperatures between -0.5 and 4°C, with the large mature females in the Beaufort Sea collected at coincident temperatures around 0.5°C where the putative mature males were found. Juveniles were not collected at bottom water temperatures below -1°C. Our sample sizes of mature females and putative mature males, and the number of sites where juvenile crabs were found are too low to identify clearer patterns. In addition, bottom water temperatures fluctuate somewhat on the Chukchi shelf, especially in the northeastern Chukchi Sea (Weingartner et al. 2013).

The proportion of mature female *C. opilio* was overall low, but their widespread occurrence and full egg-clutches suggest that reproduction occurs in the Chukchi Sea, including the northeastern Chukchi lease areas. Egg-bearing female occurrence suggests that larvae get released locally in the Chukchi Sea, although the larval supply may be supplemented by advective transport from the Bering Sea as suggested by occurrence of very small crabs primarily in the southern Chukchi Sea and hardly any in the Beaufort Sea. Such a transport mechanism is well-documented for Pacific-origin zooplankton (Berline et al. 2008, Hopcroft et al. 2010). Crab larvae advected into the Chukchi Sea would have to come from as far away as south of St. Lawrence Island, as hardly any gravid females occurred north of St. Lawrence Island (Kolts et al. 2015).

Fecundity of female *C. opilio* from the Chukchi Sea appeared to scale to body size in the same fashion as in the south-eastern and northern Bering Sea (Webb 2014, Kolts et al. 2015). The size of mature females has been related to latitude and/or bottom water temperature with smaller size-at-maturity at higher latitudes and lower temperatures (Orensanz et al. 2007). Our data set did not confirm this trend within the Chukchi Sea, perhaps because the temperature gradient is not distributed latitudinally, and bottom temperatures are somewhat variable in part of the study area. Also, some very small females in the Chukchi Sea carried clutches. It remains puzzling, though, that the mature females found in the Beaufort Sea were both substantially larger than mature females in the Chukchi and at the same time lacked clutches, although they were collected during the same months. Further puzzling is that those larger mature females had very clean carapaces matching the description for shell condition index 2 as used in the Bering Sea (classified as primiparous females), while about a quarter of the mature, but much smaller, females in the Chukchi were classified as shell condition index 3 and 4, which is interpreted as multiparous in the Bering Sea (Webb 2014). We caution that the criteria used for shell condition and inferred reproductive categories established for the Bering Sea may not be transferable to snow crabs in Chukchi and Beaufort Seas.

This study showed that snow crabs from the Chukchi and Beaufort Seas are omnivorous predators, as they are in other areas (Feder and Jewett 1980, 1981; Kolts et al. 2013). Prey includes a broad range of invertebrates and fishes. In the northeastern Chukchi lease areas, polychaetes and bivalves were common prey items. The different isotope signature in the study region generally matched the diet content results showing the similarity between the Chukchi and western Beaufort seas, but differences to the central and Canadian Beaufort Sea. Gender and size differences in diets, however, were limited. Patterns in stable isotope values are consistent with our and other published data (Dunton et al. 2012, Divine et al. 2015) that document greater influence of terrestrial (lighter in carbon isotopes) organic matter in sediments and consumer taxa in the central and Canadian Beaufort Sea from the Colville, Mackenzie and smaller rivers, compared to the Chukchi Sea. Crabs from the central and Canadian Beaufort Sea were, however, also larger because few smaller crabs were available from that region. Cannibalism was substantial in the southern Chukchi and should be considered in assessments of mortality sources.

We confirm our hypothesized south to north gradients within the Chukchi Sea and the west to east gradients in the Alaskan Beaufort Seas in terms of snow crab densities. Crab densities did indeed appear to be highest in the southern Chukchi and were higher in the western than the central Beaufort Sea. Body sizes, however, did not display a clear south to north gradient, rather the largest crabs found on the Beaufort Sea slope, while Chukchi crabs were mostly <60 mm CW. These large mature females and putative mature males in the Beaufort Sea remain puzzling in various respects and warrant further study. As hypothesized, the smallest mature females were found in the northern compared to the southern Chukchi Sea, and, because clutch size relates to body size, their fecundity was lower in those northern Chukchi areas where bottom temperatures were coldest. The mature females in the Beaufort Sea, in contrast, were larger but not gravid. Diets varied between regions and differed most between the large crabs from the central and Canadian Beaufort Sea slopes and all smaller Chukchi and western Beaufort shelf crabs. Snow crabs are common in the northeastern Chukchi lease areas, but are essentially absent from the Beaufort Sea lease areas, although they do occur offshore of those on the upper slope.

Presentations and Publications

Presentations

2015

Divine L, Iken K, Bluhm BA, Foy R, Lauth R, Norcross B, Aydin K, Whitehouse A. Snow crab (*Chionoecetes opilio*) ecology in the Alaskan Arctic. **Alaska Marine Science Symposium**, Anchorage, AK, January 2015 (oral)

Iken K, Bluhm BA, Divine L. Snow crabs in the Chukchi and Beaufort Seas. **Coastal Marine Institute Annual Review**, Anchorage, AK, January 2015 (oral)

2014

Divine L, Iken K, Bluhm BA. Evaluating the trophic role of Arctic snow crabs using stomach content and stable isotope analyses. **Interagency Crab Meeting**, Kodiak, AK, December 2014 (oral)

Divine L, Aydin K, Bluhm BA, Foy R, Gray B, Iken K, Lauth R, Norcross B, Whitehouse A. Snow crab ecology in the Chukchi Sea. **Arctic Eis project PI meeting**, Juneau, AK, June 2014 (oral)

Divine L, Bluhm BA, Iken K. Arctic snow crab (*Chionoecetes opilio*) diets: comparison of stable $\delta\,^{15}N$ and $\delta^{13}C$ isotope and stomach content analyses. **Alaska Marine Science Symposium**, Anchorage, AK, January 2014 (poster)

Iken K, Bluhm BA, Divine L. Snow crabs in the Chukchi and Beaufort Seas. **Coastal Marine Institute Annual Review**, Anchorage, AK, January 2014 (oral)

2013

Bluhm BA, Iken K, Divine L. *Chionoecetes opilio* population structure in the Chukchi and Beaufort Seas: Trophic ecology. **Interagency Crab Meeting**, Anchorage, AK, December 2013 (oral)

Divine L, Iken K, Bluhm BA. Arctic snow crab (*Chionoecetes opilio*) diets: a comparison of stomach content and stable $\delta\ ^{13}C$ and $\delta\ ^{15}N$ isotope analysis. **American Fisheries Society Meeting**, Alaska Chapter, Fairbanks, AK, October 2013 (oral)

Bluhm BA, Iken K. Population assessment of snow crab, *Chionoecetes opilio*, in the Chukchi and Beaufort Seas: preliminary findings. **28th Lowell Wakefield Symposium**, Anchorage, AK, March 2013 (oral)

Divine L, Iken K, Bluhm BA. Can you stomach it?: preliminary diet and stable isotope analysis of snow crab (*Chionoecetes opilio*) in the Alaskan Arctic. **28th Lowell Wakefield Symposium**, Anchorage, AK, March 2013 (poster– *best student poster award*)

Bluhm BA, Iken K. Population assessment of snow crab, *Chionoecetes opilio*, in the Chukchi Sea: preliminary findings. **Alaska Marine Science Symposium**, Anchorage, AK, January 2013 (poster)

Divine L, Iken K, Bluhm BA. Regional benthic food-web structure on the Alaskan Beaufort Sea shelf. **Alaska Marine Science Symposium**, Anchorage, AK, January 2013 (poster)

Divine L, Bluhm BA, Iken K. *Chionoecetes opilio* population assessment in the Chukchi and Beaufort Seas: Trophic ecology. **Coastal Marine Institute Annual Review**, Fairbanks, AK, January 2013(oral)

2012

Bluhm BA, Iken K, Divine L. *Chionoecetes opilio* population structure in the Pacific Arctic: preliminary results. **Institute of Marine Science seminar** series, November 2012 (oral)

Divine L, Iken K, Bluhm BA. Snow crabs (*C. opilio)* in the Alaskan Arctic: contributing to stock assessment data for the AFMP. **Interagency Crab Meeting**. Kodiak, AK, December 2012 (oral)

Bluhm BA, Iken K. *Chionoecetes opilio* population structure in the Pacific Arctic: preliminary results. **CMI Annual Review**, Fairbanks, AK, November 2012 (oral)

Bluhm BA, Iken K. Population assessment of snow crab, *Chionoecetes opilio*, in the Chukchi and Beaufort Seas: preliminary findings. **Institute of Marine Science Seminar Series**, Fairbanks, AK, November 2012 (oral)

Divine L, Iken K, Bluhm BA. Population structure and trophic positioning of snow crabs (*Chionoecetes opilio)* in the Alaskan Arctic. **Alaska Chapter of the American Fisheries Society.** Kodiak, AK, October 2012 (oral)

Bluhm BA, Iken K. Population assessment of snow crab, *Chionoecetes opilio*, in the Beaufort Sea including oil and gas lease sale areas – first results. **BOEM UAF campus visit** (K. Wedemeyer), July 2012

Divine L, Iken K. Snow crab (*Chionoecetes opilio*) stock characteristics and trophic dynamics in the Alaskan Arctic. **University of Alaska Fairbanks chapter of the American Fisheries Society**. Fairbanks, AK, February 2012 (oral)

Bluhm BA, Iken K. Population assessment of snow crab, *Chionoecetes opilio*, in the Beaufort Sea: preliminary findings. **Alaska Marine Science Symposium**, Anchorage, AK, January 2012 (poster)

Divine L, Iken K, Bluhm BA. Fitting snow crabs (*Chionoecetes opilio*) into the benthic food web of the central Alaskan Beaufort Sea. **Alaska Marine Science Symposium**. Anchorage, AK, January 2012 (poster)

2011

Bluhm BA, Iken K. Population assessment of snow crab, *Chionoecetes opilio*, in the Chukchi and Beaufort Seas including oil and gas lease areas: First results. **CMI Annual Review,** Fairbanks, AK, Nov 2011(oral)

Publications in progress and planned

Divine L, Bluhm BA, Mueter FJ, Iken K. Diet analysis of Alaska Arctic snow crabs (*Chionoecetes opilio*) using stomach contents and $\delta^{13}C$ and $\delta^{15}N$ stable isotopes. Submitted to Deep-Sea Research II

Bluhm BA, Iken K. Reproductive ecology of snow crab (*Chionoecetes opilio*) from the Chukchi Sea. Journal and submission date to be determined.

Broader Impacts

In total, one PhD student, two master students, three undergraduate students, two technicians, and one volunteer participated in this project. The diet and stable isotope trophic objectives of the project form a chapter of the PhD dissertation of L. Divine. An undergraduate used the project for experiential learning credit required to complete his undergraduate Fisheries degree and is now a permanent employee with the Alaska Department of Fish & Game.

Two master students (who did their thesis work on other projects) helped with sample processing at sea. Three undergraduate students assisted with crab measurements and dissections in the lab. A summer technician and a long-term technician helped with crab measurements, dissections, egg counts, and spermathecae processing in the lab. The summer technician is now a graduate student continuing work on epibenthic communities and food web structure in the Chukchi Sea. A volunteer graduate student also helped with the egg counts. All students and staff received training and gained experience that will be useful in their future careers.

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Appendix I: Abundance and Biomass

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww 1000m^{-2}	Abundance ind 1000m^{-2}	Bottom Temp. (°C)	Bottom Salinity
RUSALCA2004	6	65.675	-168.296	SC	shelf	50	1564	141	0.61	34.81
RUSALCA2004	18	68.982	-166.885	SC	shelf	46	41612	2444	-0.27	31.07
RUSALCA2004	10	66.000	-169.620	SC	shelf	49	322	8	0.55	34.83
RUSALCA2004	11	66.930	-170.990	SC	shelf	43	560	50	0.45	34.85
RUSALCA2004	13	67.430	-169.640	SC	shelf	51	7330	1303	-0.62	30.99
RUSALCA2004	15	67.870	-168.320	SC	shelf	59	350	30	-0.38	29.21
RUSALCA2004	17	68.317	-167.074	SC	shelf	38	89	9	-0.84	31.67
RUSALCA2004	20	69.000	-168.864	SC	shelf	54	1597	269	-1.32	32.15
RUSALCA2004	23	68.515	-171.457	SC	shelf	56	620	1504	-1.21	31.51
RUSALCA2004	25	67.859	-172.572	SC	shelf	49	1584	84	-1.18	31.73
RUSALCA2004	27	67.409	-173.640	SC	shelf	34	61	2	-1.19	31.73
RUSALCA2004	58	71.436	-174.365	NEC	shelf	60	5321	100	-1.05	30.96
RUSALCA2004	62	71.391	-174.871	NEC	shelf	77	2066	56	-1.08	30.97
RUSALCA2004	73	71.912	-175.452	NEC	shelf	71	598	223	-1.23	31.20
RUSALCA2004	85	72.316	-175.987	NEC	shelf	101	191	8	-1.49	32.52
RUSALCA2004	106	70.759	-175.521	NEC	shelf	72	3784	96	-1.24	33.80
RUSALCA2004	107	70.895	-172.720	NEC	shelf	40	2260	95	0.48	34.73
Oscar Dyson 2007	OD-1	65.647	-168.412	SC	shelf	52	0	0	-0.58	34.20
Oscar Dyson 2007	OD-5	69.990	-165.711	NEC	shelf	43	1173	39	-1.44	32.58
Oscar Dyson 2007	OD-15	69.504	-168.025	NEC	shelf	51	344	197	-1.41	32.46
Oscar Dyson 2007	OD-20	68.510	-167.977	SC	shelf	55	1675	48	0.61	34.81
Oscar Dyson 2007	OD-22	68.010	-167.994	SC	shelf	56	1936	97	0.57	34.78
Oscar Dyson 2007	OD-31	67.065	-166.086	SC	shelf	31	993	115	-1.26	33.64
Oscar Dyson 2007	OD-43	65.123	-168.066	SC	shelf	50	256	27	0.59	missing
Oshoru Maru 2007	OM-C02	66.641	-168.865	SC	shelf	41	2548	3496	-0.90	34.03
Oshoru Maru 2007	OM-C10	68.863	-166.819	SC	shelf	40	1520	615	-0.30	34.40
Oshoru Maru 2007	OM-C15	68.899	-168.918	SC	shelf	50	4285	843	missing	missing
Oshoru Maru 2007	OM-C16	70.015	-167.991	NEC	shelf	45	2243	441	-1.50	32.64
Oshoru Maru 2007	OM-C19	70.019	-163.714	NEC	shelf	26	649	14	-1.43	32.50
Oshoru Maru 2007	OM-C24	71.079	-167.080	NEC	shelf	43	1909	831	-1.45	32.63
Oshoru Maru 2008	C02	66.678	-168.665	SC	shelf	36	47408	3382	0.39	34.85

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww $1000m^{-2}$	Abundance ind $1000m^{-2}$	Bottom Temp. (°C)	Bottom Salinity
Oshoru Maru 2008	C04R	67.545	-168.558	SC	shelf	47	30811	2025	0.43	34.84
Oshoru Maru 2008	C09	68.187	-167.197	SC	shelf	44	15915	851	0.43	34.84
Oshoru Maru 2008	C12	68.859	-167.838	SC	shelf	47	9775	289	0.40	34.84
Oshoru Maru 2008	C14	68.510	-168.575	SC	shelf	50	111552	3479	missing	missing
Oshoru Maru 2008	C15	68.872	-168.687	SC	shelf	51	76406	1910	-0.27	31.83
Oshoru Maru 2008	C17	70.180	-166.284	NEC	shelf	43	3058	264	0.42	34.84
Oshoru Maru 2008	C18	70.099	-164.992	NEC	shelf	38	134	9	0.43	34.85
Oshoru Maru 2008	C21	70.498	-164.749	NEC	shelf	42	1521	76	0.45	34.85
Oshoru Maru 2008	C22	70.574	-165.939	NEC	shelf	41	855	214	0.46	34.84
Oshoru Maru 2008	C31	69.501	-167.022	NEC	shelf	44	1113	387	0.49	34.85
Oshoru Maru 2008	E03	70.060	-167.164	NEC	shelf	44	4035	655	0.41	34.83
Oshoru Maru 2008	E05	70.481	-166.753	NEC	shelf	46	10459	4017	0.35	34.83
Oshoru Maru 2008	E08	71.085	-166.130	NEC	shelf	41	6166	867	0.45	31.82
Oshoru Maru 2008	M04-04	70.632	-166.744	NEC	shelf	45	2305	603	0.44	34.84
COMIDA2009	chuk1	69.040	-166.593	NEC	shelf	38	3252	186	-0.72	32.07
COMIDA2009	chuk2	69.502	-167.675	NEC	shelf	49	17032	988	-1.12	32.03
COMIDA2009	chuk3	69.829	-165.500	NEC	shelf	41	1	3	missing	missing
COMIDA2009	chuk4	70.023	-163.761	NEC	shelf	28	122	18	-1.08	32.10
COMIDA2009	chuk6	70.345	-165.450	NEC	shelf	46	3926	196	-1.19	32.08
COMIDA2009	chuk7	70.469	-166.086	NEC	shelf	46	15826	940	-0.72	32.17
COMIDA2009	chuk10	70.671	-167.083	NEC	shelf	54	607	42	missing	missing
COMIDA2009	chuk12	70.697	-165.441	NEC	shelf	45	7875	285	-1.23	32.36
COMIDA2009	chuk13	70.747	-164.176	NEC	shelf	51	1012	260	missing	missing
COMIDA2009	chuk14	70.642	-162.266	NEC	shelf	42	1514	151	2.90	32.50
COMIDA2009	chuk16	70.919	-165.421	NEC	shelf	44	3741	229	1.70	31.90
COMIDA2009	chuk17	71.077	-166.178	NEC	shelf	45	13092	1034	9.80	31.90
COMIDA2009	chuk18	70.935	-166.474	NEC	shelf	45	39180	1860	4.80	31.90
COMIDA2009	chuk20	71.207	-168.311	NEC	shelf	51	23428	1601	3.40	32.50
COMIDA2009	chuk21	71.485	-167.782	NEC	shelf	51	13018	1077	-0.70	32.20
COMIDA2009	chuk23	71.387	-166.276	NEC	shelf	46	38271	1533	-0.60	33.10
COMIDA2009	chuk24	71.249	-165.448	NEC	shelf	44	6536	394	-1.10	32.80

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww $1000m^{-2}$	Abundance ind $1000m^{-2}$	Bottom Temp. (°C)	Bottom Salinity
COMIDA2009	chuk26	71.077	-162.558	NEC	shelf	47	369	47	-1.40	32.70
COMIDA2009	chuk29	71.298	-161.689	NEC	shelf	51	2029	328	1.50	32.20
COMIDA2009	chuk30	71.453	-162.611	NEC	shelf	47	1518	165	-1.10	32.40
COMIDA2009	chuk32	71.396	-164.109	NEC	shelf	47	5290	457	-1.40	32.70
COMIDA2009	chuk33	71.569	-165.769	NEC	shelf	44	36054	1908	-1.70	33.00
COMIDA2009	chuk34	71.676	-166.444	NEC	shelf	47	61850	4538	-1.30	32.70
COMIDA2009	chuk37	72.046	-166.340	NEC	shelf	48	8719	661	4.71	31.32
COMIDA2009	chuk42	72.062	-164.131	NEC	shelf	41	3989	565	4.30	Nan
COMIDA2009	chuk43	72.404	-164.958	NEC	shelf	51	10115	1826	2.01	32.29
COMIDA2009	chuk44	72.282	-163.289	NEC	shelf	42	23372	1491	-0.12	32.29
COMIDA2009	chuk45	72.116	-162.055	NEC	shelf	28	7190	910	1.10	32.39
COMIDA2009	chuk47	71.377	-159.468	NEC	shelf	54	11481	1853	1.21	32.35
COMIDA2009	chuk48	71.412	-157.492	NEC	shelf	130	6202	908	-0.02	32.45
RUSALCA2009	CEN3	70.291	-176.747	NEC	shelf	58	31836	2034	2.08	32.13
RUSALCA2009	CL 1	68.965	-166.867	SC	shelf	49	4053	216	-0.17	32.36
RUSALCA2009	CL 10	67.419	-173.610	SC	shelf	38	4898	686	-0.95	32.61
RUSALCA2009	CL 3	69.016	-168.923	SC	shelf	56	16973	351	0.57	32.23
RUSALCA2009	CL 6	68.513	-171.559	SC	shelf	57	74520	2216	-0.17	32.36
RUSALCA2009	CL 8	67.878	-172.592	SC	shelf	50	60355	3602	-0.95	32.61
RUSALCA2009	CS 17	68.312	-167.048	SC	shelf	40	1152	96	4.36	32.23
RUSALCA2009	CS 4	66.948	-170.930	SC	shelf	45	12606	1105	-1.45	32.68
RUSALCA2009	CS8	67.446	-169.552	SC	shelf	51	53516	2096	0.21	32.30
RUSALCA2009	HC 49	73.336	-175.695	NEC	shelf	152	10351	630	3.71	32.24
RUSALCA2009	HC 55	73.000	-174.080	NEC	shelf	94	4437	266	1.08	32.15
RUSALCA2009	LS 1	69.792	177.979	NEC	shelf	44	37	37	3.96	32.25
RUSALCA2009	SS 4	71.880	173.129	NEC	shelf	42	85	42	1.57	32.10
RUSALCA2009	WN 1	71.670	179.485	NEC	shelf	33	0	0	2.15	32.15
RUSALCA2009	WN 3	72.648	177.601	NEC	shelf	74	1484	111	6.12	31.92
WWW1003	BF001	71.110	-163.800	NEC	shelf	40.7	1	1	0.69	32.40
WWW1003	BF001	71.110	-163.800	NEC	shelf	40.7	1	1	-0.80	32.53
WWW1003	BF003	71.110	-163.030	NEC	shelf	42.8	2480	21	-1.50	32.58

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww 1000m^{-2}	Abundance ind 1000m^{-2}	Bottom Temp. (°C)	Bottom Salinity
WWW1003	BF003	71.110	-163.040	NEC	shelf	43.5	474	19	-1.63	32.82
WWW1003	BF005	71.100	-162.270	NEC	shelf	44.9	205	49	0.39	32.21
WWW1003	BF005	71.100	-162.260	NEC	shelf	44.5	638	32	0.22	32.16
WWW1003	BF009	71.230	-162.640	NEC	shelf	43.6	1771	236	0.70	32.40
WWW1003	BF009	71.230	-162.630	NEC	shelf	44.1	3397	400	0.81	32.42
WWW1003	BF009	71.230	-162.630	NEC	shelf	44	2954	257	0.75	32.19
WWW1003	BF011	71.370	-163.790	NEC	shelf	42.7	1	1	0.75	32.41
WWW1003	BF011	71.370	-163.790	NEC	shelf	43.2	9927	902	-1.65	32.92
WWW1003	BF013	71.360	-163.010	NEC	shelf	43.2	2419	129	-1.53	32.64
WWW1003	BF015	71.350	-162.230	NEC	shelf	42.7	295	40	-0.94	32.48
WWW1003	BF015	71.350	-162.230	NEC	shelf	42.7	67	7	-1.24	32.59
WWW1003	BF015	71.350	-162.230	NEC	shelf	43	6822	558	-1.57	32.91
WWW1003	BF015	71.350	-162.230	NEC	shelf	43	484	4	-1.62	32.81
WWW1003	BF015	71.350	-162.200	NEC	shelf	43.1	3547	296	0.57	32.23
WWW1003	BF017	71.490	-163.390	NEC	shelf	40.2	278	36	0.70	32.35
WWW1003	BF017	71.490	-163.380	NEC	shelf	40.2	663	7	-0.45	32.48
WWW1003	BF017	71.490	-163.380	NEC	shelf	40.2	6796	598	-1.63	32.67
WWW1003	BF019	71.480	-162.600	NEC	shelf	41.6	3217	536	-1.50	32.78
WWW1003	BF019	71.480	-162.600	NEC	shelf	41.8	11874	1602	-1.30	32.60
WWW1003	BF019	71.480	-162.600	NEC	shelf	41.8	699	70	-0.65	32.55
WWW1003	BF021	70.870	-165.180	NEC	shelf	39	1086	109	0.30	32.44
WWW1003	BF021	71.620	-163.760	NEC	shelf	38.6	10356	888	-1.42	32.73
WWW1003	BF023	71.610	-162.990	NEC	shelf	39.7	4133	827	0.34	32.39
WWW1003	BF023	71.610	-162.980	NEC	shelf	40.9	2311	377	-1.39	32.79
WWW1003	BF023	71.610	-162.970	NEC	shelf	40.2	378	57	-0.65	32.55
WWW1003	BF025	71.600	-162.200	NEC	shelf	41.4	2034	262	-1.34	32.69
WWW1003	BF025	71.600	-162.200	NEC	shelf	41.8	3480	667	-1.73	33.01
WWW1003	BF025	71.600	-162.190	NEC	shelf	41.3	417	69	-0.91	32.48
WWW1003	KF001	70.640	-166.000	NEC	shelf	40.5	1527	38	-1.58	33.01
WWW1003	KF001	70.650	-165.990	NEC	shelf	40.4	1	1	-1.37	32.97
WWW1003	KF001	70.650	-166.010	NEC	shelf	40.4	4656	94	-0.91	32.48

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww $1000m^{-2}$	Abundance ind $1000m^{-2}$	Bottom Temp. (°C)	Bottom Salinity
WWW1003	KF003	70.650	-165.240	NEC	shelf	40.3	9	11	-1.44	32.96
WWW1003	KF003	70.650	-165.240	NEC	shelf	40.7	215	11	-1.52	32.78
WWW1003	KF003	70.650	-165.260	NEC	shelf	39.8	2741	49	-1.32	32.67
WWW1003	KF005	70.650	-164.510	NEC	shelf	45.1	2257	290	-1.54	32.51
WWW1003	KF005	70.650	-164.500	NEC	shelf	44.2	475	62	0.75	32.19
WWW1003	KF005	70.650	-164.500	NEC	shelf	44.4	1912	1912	-1.45	32.68
WWW1003	KF007	70.770	-165.630	NEC	shelf	38.9	1697	54	3.08	32.53
WWW1003	KF007	70.770	-165.610	NEC	shelf	38.9	1	1	-1.59	32.84
WWW1003	KF007	70.780	-165.640	NEC	shelf	38.4	163	3	-1.43	32.82
WWW1003	KF009	70.770	-164.870	NEC	shelf	37.4	1052	30	2.32	31.64
WWW1003	KF009	70.770	-164.890	NEC	shelf	38.4	2611	163	-1.54	32.66
WWW1003	KF009	70.770	-164.870	NEC	shelf	37.3	166	8	-0.95	32.61
WWW1003	KF011	70.890	-166.020	NEC	shelf	39.5	15174	793	0.20	32.06
WWW1003	KF011	70.900	-166.010	NEC	shelf	39.5	4341	178	-0.98	32.40
WWW1003	KF011	70.890	-166.020	NEC	shelf	39.3	7591	100	-0.95	32.61
WWW1003	KF013	70.900	-165.250	NEC	shelf	39	1983	103	0.14	31.94
WWW1003	KF013	70.900	-165.270	NEC	shelf	39.5	2128	94	-1.66	32.74
WWW1003	KF013	70.900	-165.260	NEC	shelf	38.9	1499	41	-0.72	32.51
WWW1003	KF015	70.900	-164.490	NEC	shelf	36	307	35	0.26	32.23
WWW1003	KF017	71.020	-165.630	NEC	shelf	40.5	1	1	0.57	32.10
WWW1003	KF017	71.020	-165.630	NEC	shelf	40.8	1345	67	-1.73	32.81
WWW1003	KF017	71.020	-165.640	NEC	shelf	40.4	6989	178	-1.45	32.68
WWW1003	KF021	71.150	-166.020	NEC	shelf	41.1	1601	54	0.26	32.24
WWW1003	KF021	71.140	-166.030	NEC	shelf	40.7	2326	110	-1.57	32.58
WWW1003	KF021	71.140	-166.030	NEC	shelf	40.7	22330	262	-1.51	32.72
WWW1003	KF023	71.150	-165.240	NEC	shelf	42.4	610	41	-1.47	32.46
WWW1003	KF023	71.150	-165.250	NEC	shelf	41.6	6636	277	-1.51	32.72
WWW1003	KF025	71.150	-164.480	NEC	shelf	41	341	4	-0.75	32.35
WWW1003	SF007	71.750	-164.950	NEC	shelf	37.6	1891	126	-0.72	32.51
WWW1003	SF009	71.740	-164.150	NEC	shelf	35.6	191	27	-1.43	32.82
WWW1003	SF011	71.740	-163.360	NEC	shelf	38.7	1111	88	-1.18	32.87

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww 1000m^{-2}	Abundance ind 1000m^{-2}	Bottom Temp. (°C)	Bottom Salinity
WWW1003	SF014	71.870	-164.550	NEC	shelf	37.6	3428	237	-1.18	32.87
WWW1003	SF016	71.870	-163.760	NEC	shelf	40	837	93	3.50	32.18
WWW1003	SF020	71.990	-164.140	NEC	shelf	36.3	1927	164	-1.51	32.72
WWW1003	SF022	71.980	-163.330	NEC	shelf	37.6	1548	120	4.47	32.20
WWW1003	TF001	71.000	-164.200	NEC	shelf	40	61	6	3.90	32.12
COMIDA2010	chuk11	70.733	-165.997	NEC	shelf	40	4844	174	3.71	32.24
COMIDA2010	chuk15	71.021	-164.255	NEC	shelf	42	3730	63	-0.95	32.61
COMIDA2010	chuk19	71.028	-166.953	NEC	shelf	45	20658	759	3.50	32.18
COMIDA2010	chuk22	71.272	-167.014	NEC	shelf	50	14461	346	-0.65	32.55
COMIDA2010	chuk35	71.669	-166.917	NEC	shelf	45	24941	783	3.71	32.24
COMIDA2010	chuk36	71.930	-167.389	NEC	shelf	48	32697	978	2.15	32.15
COMIDA2010	chuk38	71.927	-165.161	NEC	shelf	36	16136	997	1.57	32.10
COMIDA2010	chuk39	71.702	-164.515	NEC	shelf	38	1730	67	3.96	32.25
COMIDA2010	chuk40	71.725	-163.456	NEC	shelf	40	3750	274	2.08	32.13
COMIDA2010	chuk41	71.707	-162.482	NEC	shelf	40	3944	347	3.90	32.12
COMIDA2010	chuk46	72.117	-162.055	NEC	shelf	25	213	4	-1.18	32.87
COMIDA2010	chuk49	71.767	-159.373	NEC	shelf	51	3563	188	-1.43	32.82
COMIDA2010	chuk9	70.831	-167.787	NEC	shelf	55	8601	524	4.47	32.20
COMIDA2010	chuk005	70.405	-164.482	NEC	shelf	45	596	91	2.08	32.13
COMIDA2010	chuk1010	71.269	-160.716	NEC	shelf	52	2676	268	1.08	32.15
COMIDA2010	chuk1013	71.933	-162.668	NEC	shelf	38	3709	209	4.47	32.20
COMIDA2010	chuk1014	70.840	-163.291	NEC	shelf	45	795	53	-1.51	32.72
COMIDA2010	chuk1016	70.710	-165.253	NEC	shelf	45	4696	126	2.15	32.15
COMIDA2010	chuk103	67.670	-168.958	NEC	shelf	50	9270	317	3.90	32.12
COMIDA2010	chuk105	68.974	-168.945	NEC	shelf	50	7222	143	1.57	32.10
COMIDA2010	chuk107	70.086	-166.455	NEC	shelf	47	6890	343	3.96	32.25
COMIDA2010	chuk108	72.101	-162.975	NEC	shelf	36	9270	676	4.36	32.23
COMIDA2010	chuk109	72.104	-161.190	NEC	shelf	30	1265	65	3.50	32.18
BeauFish 2011	CB01	70.515	-147.325	WCB	shelf	20	0	0	3.70	25.80
BeauFish 2011	CB02	70.554	-147.740	WCB	shelf	25	0	0	7.72	31.13
BeauFish 2011	CB03	70.607	-148.201	WCB	shelf	20	0	0	-1.50	31.50

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww $1000m^{-2}$	Abundance ind $1000m^{-2}$	Bottom Temp. (°C)	Bottom Salinity
BeauFish 2011	CB04	70.623	-148.692	WCB	shelf	20	0	0	-1.50	32.80
BeauFish 2011	CB05	70.661	-149.163	WCB	shelf	16	0	0	-1.80	33.40
BeauFish 2011	CB06	70.696	-149.689	WCB	shelf	16	0	0	-1.80	32.90
BeauFish 2011	CB07	70.738	-150.137	WCB	shelf	16	0	0	-1.10	33.30
BeauFish 2011	CB08	70.723	-150.520	WCB	shelf	16	0	0	missing	missing
BeauFish 2011	CB09	70.814	-151.105	WCB	shelf	14	0	0	-0.90	29.30
BeauFish 2011	CB10	70.857	-151.589	WCB	shelf	14	0	0	0.40	33.50
BeauFish 2011	CB11	70.770	-147.153	WCB	shelf	45	0	0	1.64	29.44
BeauFish 2011	CB12	70.802	-147.546	WCB	shelf	38	0	0	3.12	30.42
BeauFish 2011	CB13	70.827	-148.063	WCB	shelf	40	0	0	1.64	29.44
BeauFish 2011	CB14	70.856	-148.589	WCB	shelf	33	0	0	0.85	29.15
BeauFish 2011	CB15	70.925	-149.041	WCB	shelf	30	0	0	3.92	31.51
BeauFish 2011	CB16	70.961	-149.548	WCB	shelf	30	0	0	3.04	30.96
BeauFish 2011	CB17	71.000	-150.002	WCB	shelf	30	0	0	3.82	32.05
BeauFish 2011	CB20	71.119	-151.426	WCB	shelf	17	0	0	-1.60	33.20
BeauFish 2011	CB22	70.995	-147.467	WCB	slope	180	0	0	3.70	32.90
BeauFish 2011	CB23	71.069	-147.881	WCB	slope	180	185.6	2.32	7.80	32.10
BeauFish 2011	CB24	71.160	-148.342	WCB	slope	180	102.24	1.42	6.40	31.40
BeauFish 2011	CB25	71.210	-148.831	WCB	slope	176	399.05	3.47	3.10	32.50
BeauFish 2011	CB26	71.211	-149.380	WCB	slope	180	138	1.38	1.40	32.40
BeauFish 2011	CB27	71.216	-149.872	WCB	slope	180	611.24	5.18	6.50	30.80
BeauFish 2011	CB28	71.253	-150.422	WCB	slope	180	341.25	2.73	3.20	32.20
BeauFish 2011	CB28b	71.255	-150.446	WCB	slope	180	358	6.36	1.40	32.80
BeauFish 2011	CB29	71.320	-150.950	WCB	slope	180	273.6	2.88	1.00	32.60
BeauFish 2011	CB30	71.364	-151.400	WCB	slope	180	0	0	1.10	32.90
BeauFish 2011	CB31	70.909	-151.841	WCB	shelf	14	0	0	0.40	33.50
BeauFish 2011	CB32	70.813	-151.647	WCB	shelf	10	0	0		
BeauFish 2011	CB33	70.680	-150.691	WCB	shelf	13	0	0		
BeauFish 2011	CB34a	71.278	-150.653	WCB	slope	180	1110	10	-1.20	32.70
BeauFish 2011	CB34b	71.278	-150.656	WCB	slope	180	1242	20.9	-0.80	33.30
BeauFish 2011	CB35a	71.288	-150.670	WCB	slope	220	2169	28.7	2.20	32.70

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww $1000m^{-2}$	Abundance ind $1000m^{-2}$	Bottom Temp. (°C)	Bottom Salinity
BeauFish 2011	CB35b	71.287	-150.660	WCB	slope	220	2548.48	28.16	1.50	32.20
BeauFish 2011	EB02	70.865	-146.676	EB	shelf	62	0	0	1.91	32.13
BeauFish 2011	EB10	70.561	-146.142	EB	shelf	38	0	0	-0.22	32.49
BeauFish 2011	EB12	70.788	-146.094	EB	shelf	60	0	0	-0.33	32.44
BeauFish 2011	EB14	70.456	-145.807	WCB	shelf	35	0	0	3.91	30.02
BeauFish 2011	EB16	70.674	-145.807	WCB	shelf	53	0	0	7.90	31.30
BeauFish 2011	EB19	70.336	-145.427	WCB	shelf	30	0	0	3.82	32.05
BeauFish 2011	EB21	70.578	-145.409	WCB	shelf	49	0	0	1.70	33.20
BeauFish 2011	EB23	70.783	-145.451	EB	slope	124	0	0		
BeauFish 2011	EB25	70.234	-145.094	EB	shelf	24	0	0	-0.05	32.50
BeauFish 2011	EB27	70.463	-145.076	EB	shelf	40	0	0	-0.84	32.53
BeauFish 2011	EB29	70.677	-145.101	EB	shelf	62	0	0		
BeauFish 2011	EB32	70.926	-146.435	EB	slope	180	0	0		
BeauFish 2011	EB4	70.443	-146.438	EB	shelf	31	0	0	-1.01	32.53
BeauFish 2011	EB6	70.675	-146.413	EB	shelf	42	0	0	-0.10	32.36
BeauFish 2011	EB8	70.339	-146.123	EB	shelf	26	0	0	-0.50	32.47
BeauFish 2011	WB02	71.738	-154.957	WCB	slope	180	0	0	-0.20	33.10
BeauFish 2011	WB04	71.841	-153.902	WCB	slope	180	631.68	7.52	1.80	32.70
BeauFish 2011	WB05	71.810	-154.409	WCB	slope	152	295.62	3.79	3.30	32.30
BeauFish 2011	WB07	71.711	-152.975	WCB	slope	180	607.32	2.5282	3.20	32.00
BeauFish 2011	WB07b	71.714	-152.979	WCB	slope	180	376.25	3.01	2.30	32.20
BeauFish 2011	WB08	71.652	-152.649	WCB	slope	180	0	0	1.80	32.80
BeauFish 2011	WB10	71.720	-153.871	WCB	shelf	50	0	0	2.80	32.60
BeauFish 2011	WB12	71.482	-153.992	WCB	shelf	49	0	0	2.50	32.90
BeauFish 2011	WB13	71.397	-153.995	WCB	shelf	40	415.8	5.25	3.26	30.50
BeauFish 2011	WB14	71.237	-153.105	WCB	shelf	38	0	0	-0.13	27.86
BeauFish 2011	WB15	71.379	-153.023	WCB	shelf	78	0	0	1.70	33.00
BeauFish 2011	WB16	71.452	-153.011	WCB	shelf	62	200.64	3.04	2.20	32.90
BeauFish 2011	WB17	71.155	-152.210	WCB	shelf	21	0	0	-0.10	34.50
BeauFish 2011	WB18	71.283	-152.270	WCB	shelf	48	0	0	10.50	30.60
BeauFish 2011	WB19	71.352	-151.964	WCB	shelf	86	0	0	7.10	31.90

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww 1000m^{-2}	Abundance ind 1000m^{-2}	Bottom Temp. (°C)	Bottom Salinity
BeauFish 2011	WB20	71.501	-152.184	WCB	slope	181	571.35	8.79	1.10	32.40
BeauFish 2011	WB21	71.589	-155.064	WCB	shelf	45	462	16.8	1.31	26.83
BeauFish 2011	WB22	71.684	-154.484	WCB	shelf	48	0	0	3.00	32.60
BeauFish 2011	WB23	71.530	-152.847	WCB	shelf	58	0	0	3.70	32.30
BeauFish 2011	WB24	71.507	-153.558	WCB	shelf	50	0	0	7.00	31.00
BeauFish 2011	WB25	71.212	-154.005	WCB	shelf	20	0	0	-0.40	30.50
BeauFish 2011	WB26	71.618	-153.845	WCB	shelf	46	417.83	9.87	-0.58	28.47
BeauFish 2011	WB27	71.859	-154.369	WCB	slope	180	0	0	-0.10	33.00
BeauFish 2011	WB28	71.684	-155.158	WCB	slope	180	207.36	3.46	3.70	28.70
BeauFish 2011	WB29	71.471	-155.023	WCB	shelf	21	0	0	-1.00	33.00
BeauFish 2011	WB30	71.237	-155.126	WCB	shelf	10	0	0		
BeauFish 2011	WB31	71.798	-153.422	WCB	slope	180	0	0	3.90	31.40
BeauFish 2011	WB31b	71.797	-153.409	WCB	slope	180	201.21	7.06	3.80	31.90
BeauFish 2011	WB32	71.733	-153.503	WCB	shelf	80	153.45	1.98	–1.5	32.90
BeauFish 2011	WB32b	71.731	-153.488	WCB	shelf	80	169.86	2.98	3.20	32.60
BeauFish 2011	WB34	71.129	-153.186	WCB	shelf	22	0	0		
BeauFish 2011	WB35	71.109	-154.046	WCB	shelf	14	0	0	-1.60	33.60
BeauFish 2011	WB36	71.562	-152.462	WCB	slope	151	0	0	2.70	32.40
Arctic Eis 2012	CH30-B01	66.495	-168.495	SC	shelf	52	446	5266	1.27	31.43
Arctic Eis 2012	CH30-C01	66.999	-168.495	SC	shelf	37	47333	53602	3.14	28.77
Arctic Eis 2012	CH30-C02	67.004	-167.216	SC	shelf	38	2268	2744	3.58	30.83
Arctic Eis 2012	CH30-C03	66.994	-165.947	SC	shelf	24	9	200	-0.63	31.81
Arctic Eis 2012	CH30-D01	67.502	-168.499	SC	shelf	47	6957	5308	1.05	31.63
Arctic Eis 2012	CH30-D02	67.494	-167.181	SC	shelf	46	30146	16810	missing	missing
Arctic Eis 2012	CH30-D03	67.509	-165.871	SC	shelf	40	425	2707	4.48	31.10
Arctic Eis 2012	CH30-E01	67.995	-168.505	SC	shelf	58	7137	3818	3.23	29.51
Arctic Eis 2012	CH30-E02	68.012	-167.185	SC	shelf	56	1001	1817	3.23	29.51
Arctic Eis 2012	CH30-E03	67.999	-165.821	SC	shelf	29	279	113	3.23	29.51
Arctic Eis 2012	CH30-F01	68.502	-168.499	SC	shelf	51	73	670	3.60	31.67
Arctic Eis 2012	CH30-G01	68.999	-168.498	SC	shelf	51	113	5945	missing	missing
Arctic Eis 2012	CH30-G03	68.998	-165.686	SC	shelf	21	7	2	3.97	31.29

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww $1000m^{-2}$	Abundance ind $1000m^{-2}$	Bottom Temp. (°C)	Bottom Salinity
Arctic Eis 2012	CH30-H01	69.494	-168.476	SC	shelf	51	321	11703	-0.70	31.87
Arctic Eis 2012	CH30-H02	69.502	-167.116	SC	shelf	47	214	8950	-0.60	31.73
Arctic Eis 2012	CH30-H03	69.496	-165.653	SC	shelf	35	7	201	0.30	31.64
Arctic Eis 2012	CH30-I01	70.004	-168.480	SC	shelf	42	8	157	1.71	31.22
Arctic Eis 2012	CH30-I03	70.003	-165.600	SC	shelf	40	41	537	-1.14	32.01
Arctic Eis 2012	CH30-I04	70.004	-164.104	SC	shelf	31	12	456	-0.75	31.84
Arctic Eis 2012	CH30-J01	70.494	-168.498	NEC	shelf	40	46	202	1.67	32.69
Arctic Eis 2012	CH30-J04	70.505	-163.999	NEC	shelf	45	80	26	5.12	31.82
Arctic Eis 2012	CH30-K01	70.995	-168.501	NEC	shelf	47	3809	983	1.57	32.82
Arctic Eis 2012	CH30-K03	70.996	-165.427	NEC	shelf	42	5224	729	1.87	32.40
Arctic Eis 2012	CH30-L01	71.506	-168.511	NEC	shelf	49	41	909	9.95	29.27
Arctic Eis 2012	CH30-L03	71.500	-165.348	NEC	shelf	43	196	27	2.27	32.48
Arctic Eis 2012	CH30-L04	71.493	-163.819	NEC	shelf	44	35	8	1.96	32.50
Arctic Eis 2012	CH30-L07	71.502	-159.031	NEC	shelf	50	14	496	9.43	29.40
Arctic Eis 2012	CH30-M02	72.007	-166.910	NEC	shelf	48	110	1193	3.79	32.09
Arctic Eis 2012	CH30-M04	72.001	-163.648	NEC	shelf	40	26	428	6.51	31.18
Arctic Eis 2012	CH30-M05	72.026	-162.247	NEC	shelf	28	112	21	7.79	30.44
Arctic Eis 2012	CH30-N02	72.507	-166.851	NEC	shelf	50	1106	138	5.97	29.12
Arctic Eis 2012	CH30-N05	72.500	-161.906	NEC	shelf	44	76	20	5.41	31.83
Arctic Eis 2012	CH30-N06	72.484	-160.229	NEC	shelf	47	957	274	7.06	31.41
Arctic Eis 2012	CH30-O02	73.000	-165.819	NEC	shelf	60	33	340	2.87	31.31
RUSALCA2012	CEN1a	70.667	-178.415	NEC	shelf	40	209	55	2.90	32.30
RUSALCA2012	CL1	68.965	-166.992	SC	shelf	50	2845	117	1.98	31.36
RUSALCA2012	CL10	67.400	-173.610	SC	shelf	34	0	0	1.30	31.48
RUSALCA2012	CL3-R	69.019	-168.845	SC	shelf		8638	164	3.09	31.24
RUSALCA2012	CL6	68.505	-171.563	SC	shelf	57	533	1743	1.38	31.41
RUSALCA2012	CL8	67.874	-172.607	SC	shelf	50	3017	60	4.21	31.23
RUSALCA2012	CS12R	67.858	-168.271	SC	shelf	58	26783	21795	1.89	31.64
RUSALCA2012	CS17	68.342	-167.089	SC	shelf	40	0	0	0.45	31.82
RUSALCA2012	CS4	66.931	-170.881	SC	shelf	45	409	11	3.17	31.52
RUSALCA2012	CS8R	67.429	-169.613	SC	shelf	52	4195	5050	1.89	31.62

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww 1000m^{-2}	Abundance ind 1000m^{-2}	Bottom Temp. (°C)	Bottom Salinity
RUSALCA2012	HC1-1	70.958	-173.975	NEC	shelf	52	586	26	1.60	32.60
RUSALCA2012	HC1-2	70.967	-173.977	NEC	shelf	53	835	38	2.20	32.50
RUSALCA2012	HC2	70.897	-175.000	NEC	shelf	70	1940	73	1.35	32.44
RUSALCA2012	HC22	71.712	-174.912	NEC	shelf	73	1361	38	8.24	29.87
RUSALCA2012	HC26	71.789	-174.352	NEC	shelf	57	3055	123	2.02	32.48
RUSALCA2012	HC3	71.032	-175.990	NEC	shelf	50	440	12	2.50	32.51
RUSALCA2012	HC70	71.638	-175.390	NEC	shelf		1	1	1.34	32.86
Transboundary 2012	B1-0020	70.738	-150.070	WCB	shelf	16.5	0	0	-1.15	32.09
Transboundary 2012	B1-0050	71.151	-150.118	WCB	shelf	51.2	0	0	-0.82	32.08
Transboundary 2012	B1-0100	71.213	-150.137	WCB	slope	102	0	0	1.87	31.79
Transboundary 2012	B1-0200	71.231	-150.130	WCB	slope	200	0	0	3.71	31.35
Transboundary 2012	B1-0350	71.244	-150.147	WCB	slope	351	5310	4	3.63	31.44
Transboundary 2012	B1-0500	71.251	-150.181	WCB	slope	500	7662	21	0.67	32.25
Transboundary 2012	B1-1000	71.308	-150.044	WCB	slope	1000	0	0	2.38	31.85
Transboundary 2012	B2-0020	71.075	-151.082	WCB	shelf	20	0	0	-0.42	31.60
Transboundary 2012	B2-0020	71.072	-151.069	WCB	shelf	20	0	0	4.33	31.37
Transboundary 2012	B2-0020	71.069	-151.057	WCB	shelf	20	0	0	4.28	31.48
Transboundary 2012	B2-0050	71.182	-151.090	WCB	shelf	50	0	0	4.28	31.48
Transboundary 2012	B2-0100	71.326	-151.160	WCB	slope	100	0	0	4.83	31.39
Transboundary 2012	B2-0200	71.388	-151.396	WCB	slope	202	0	0	3.75	31.56
Transboundary 2012	B2-0350	71.417	-151.137	WCB	slope	353	0	0	3.63	31.44
Transboundary 2012	B2-0500	71.426	-151.101	WCB	slope	509	1631	3	-1.27	32.16
Transboundary 2012	BX-0200	71.297	-150.747	WCB	slope	220	0	0	-0.94	31.95
Transboundary 2012	BX-0350	71.302	-150.681	WCB	slope	350	0	0	3.99	31.59
Transboundary 2012	BX-0500	71.317	-150.691	WCB	slope	491	8408	20	0.85	32.21
Transboundary 2013	A1-100	70.367	-141.168	EB	slope	100	0	0	2.06	32.84
Transboundary 2013	A1-1000	70.616	-141.127	EB	slope	1008	0	0	0.45	34.85
Transboundary 2013	A1-20	70.039	-141.062	EB	shelf	20	0	0	0.45	34.76
Transboundary 2013	A1-200	70.412	-141.177	EB	slope	210	0	0	-0.82	33.28
Transboundary 2013	A1-350	70.417	-141.260	EB	slope	350	0	0	0.41	34.82
Transboundary 2013	A1-50	70.336	-141.090	EB	shelf	50	0	0	0.47	34.78

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww $1000m^{-2}$	Abundance ind $1000m^{-2}$	Bottom Temp. (°C)	Bottom Salinity
Transboundary 2013	A1-500	70.458	-141.087	EB	slope	500	0	0	-0.86	33.17
Transboundary 2013	A1-750	70.537	-141.096	EB	slope	752	0	0	6.86	31.52
Transboundary 2013	A2-100	70.127	-142.278	EB	slope	101	0	0	0.16	34.56
Transboundary 2013	A2-20	69.717	-141.120	EB	shelf	50	0	0	0.48	34.76
Transboundary 2013	A2-200	70.487	-141.948	EB	slope	230	0	0	-0.60	33.62
Transboundary 2013	A2-350	70.504	-141.951	EB	slope	352	0	0	-0.82	33.92
Transboundary 2013	A2-50	69.953	-142.163	EB	shelf	50	0	0	0.42	34.74
Transboundary 2013	A2-500	70.540	-142.072	EB	slope	506	0	0	-0.16	34.49
Transboundary 2013	A2-750	70.609	-142.001	EB	slope	757	0	0	-0.16	34.49
Transboundary 2013	A6-100	70.821	-146.046	EB	shelf	98	0	0	1.80	31.99
Transboundary 2013	A6-1000	71.014	-146.100	EB	slope	1004	0	0	0.14	32.31
Transboundary 2013	A6-20	70.429	-146.048	EB	shelf	34	0	0	2.38	31.85
Transboundary 2013	A6-200	70.889	-146.032	EB	slope	200	2139	3.1	1.42	31.89
Transboundary 2013	A6-350	70.921	-145.978	EB	slope	350	0	0	-1.07	32.70
Transboundary 2013	A6-50	70.675	-146.107	EB	shelf	50	0	0	1.09	31.96
Transboundary 2013	A6-500	70.969	-146.123	EB	slope	500	0	0	-1.12	32.89
Transboundary 2013	A6-750	70.981	-146.076	EB	slope	782	0	0	-1.47	32.83
Transboundary 2013	A6-mid	70.552	-146.131	EB	shelf	38	0	0	1.09	31.96
Transboundary 2013	GRY-100	70.133	-137.764	EB	slope	100	0	0	6.86	31.52
Transboundary 2013	GRY-1000	70.534	-139.268	EB	slope	960	0	0	6.68	31.33
Transboundary 2013	GRY-20	69.716	-136.652	EB	shelf	20	0	0	0.06	34.58
Transboundary 2013	GRY-200	70.096	-138.045	EB	slope	200	0	0	-0.88	33.22
Transboundary 2013	GRY-350	70.256	-138.343	EB	slope	350	0	0	-0.82	33.92
Transboundary 2013	GRY-50	69.906	-137.207	EB	shelf	55	0	0	1.09	32.56
Transboundary 2013	GRY-500	70.285	-138.631	EB	slope	505	0	0	0.16	34.63
Transboundary 2013	GRY-750	70.462	-138.845	EB	slope	756	0	0	missing	missing
Transboundary 2013	MAC-100	69.613	-137.982	EB	slope	102	0	0	-0.98	32.68
Transboundary 2013	MAC-1000	70.592	-139.782	EB	slope	980	0	0	7.00	31.34
Transboundary 2013	MAC-200	69.827	-138.420	EB	slope	197	0	0	-0.88	33.22
Transboundary 2013	MAC-50	69.460	-137.626	EB	shelf	50	0	0	0.16	34.63
Transboundary 2013	MAC-500	missing	missing	EB	slope	500	0	0	0.07	34.53

Cruise	Station	Lat deg N	Long deg	Region	Shelf/slope	Depth (m)	Biomass gww $1000m^{-2}$	Abundance ind $1000m^{-2}$	Bottom Temp. (°C)	Bottom Salinity
Transboundary 2013	TBS-100	70.246	-140.300	EB	slope	100	0	0	0.16	34.63
Transboundary 2013	TBS-1000	70.602	-140.419	EB	slope	1007	0	0	0.54	34.80
Transboundary 2013	TBS-350	70.353	-140.456	EB	slope	361	0	0	-0.82	33.92
Transboundary 2013	TBS-50	70.153	-140.379	EB	shelf	50.7	0	0	3.29	32.25
Transboundary 2013	TBS-500	70.405	-140.286	EB	slope	505	0	0	0.16	34.63
Transboundary 2013	TBS-750	70.577	-140.468	EB	slope	750	0	0	0.42	34.74

Appendix II: Egg Counts

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
Arctic Eis 12	2012	C01	66.99	-168.48	37	55.9	37.2	2	18711	5				
Arctic Eis 12	2012	C01	66.99	-168.48	37	54.1	60.9	2	33122	5				
Arctic Eis 12	2012	C01	66.99	-168.48	37	55.0	57.9	2	27653	5				
Arctic Eis 12	2012	C01	66.99	-168.48	37	59.3	72.7	2	16105	5				
Arctic Eis 12	2012	C01	66.99	-168.48	37	58.2	66.3	2	22909	6				
Arctic Eis 12	2012	D01	67.50	-168.50	49	53.0	55.6	4	26267	6				
Arctic Eis 12	2012	D01	67.50	-168.50	49	47.6	39.6	3	24439	5				
Arctic Eis 12	2012	D01	67.50	-168.50	49	53.0	68.3	3	30564	5				
Arctic Eis 12	2012	D01	67.50	-168.50	49	61.9	81.8	2	24759	5				
Arctic Eis 12	2012	D01	67.50	-168.49	47	49.7	43.3	2	28017	5				
Arctic Eis 12	2012	D01	67.50	-168.49	47	51.6	60.8	3	21685	5				
Arctic Eis 12	2012	D01	67.50	-168.49	47	57.5	82.8	4	40722	5				
Arctic Eis 12	2012	D01	67.50	-168.49	47	46.3	42.6	3	22559	5				
Arctic Eis 12	2012	D01	67.50	-168.49	47	57.0	65.0	3	13409	5				
Arctic Eis 12	2012	D01	67.50	-168.49	47	48.1	45.9	4	24411	6				
Arctic Eis 12	2012	D03	67.51	-165.87	40	48.1	39.8	4	16064	5				
Arctic Eis 12	2012	D03	67.51	-165.87	40	64.6	87.2	3	42597	5				
Arctic Eis 12	2012	E02	68.00	-167.21	56	46.2	32.3	4	4454	2				
Arctic Eis 12	2012	E02	68.00	-167.21	56	44.1	29.7	4	12529	6				
Arctic Eis 12	2012	E02	68.00	-167.21	56	42.1	24.1	3	10965	6				
Arctic Eis 12	2012	E02	68.00	-167.21	56	53.2	52.8	3	20383	5				
Arctic Eis 12	2012	E02	68.00	-167.21	56	54.8	60.9	3	37448	6				
Arctic Eis 12	2012	E02	68.00	-167.21	56	43.6	34.5	2	14354	6				
Arctic Eis 12	2012	E02	68.00	-167.21	56	51.4	47.7	3	18765	6				
Arctic Eis 12	2012	E02	68.00	-167.21	56	48.3	40.0	3	13365	6				
Arctic Eis 12	2012	E02	68.00	-167.21	56	44.1	32.1	4	6142	5				
Arctic Eis 12	2012	E02	68.00	-167.21	56	43.9	26.5	3	14583	6				
Arctic Eis 12	2012	J01	70.49	-168.49	39	53.7	59.3	2	22433	5				

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
Arctic Eis 12	2012	J01	70.49	-168.49	39	44.2	33.0	2	7844	6				
Arctic Eis 12	2012	J01	70.49	-168.49	39	52.7	63.1	3	50780	6				
Arctic Eis 12	2012	J01	70.49	-168.49	39	44.0	33.5	2	11773	6				
Arctic Eis 12	2012	J01	70.49	-168.49	39	41.3	27.4	2	9020	5				
Arctic Eis 12	2012	M08	71.99	-157.19	86	53.8	61.4	3	32756	6				
Arctic Eis 12	2012	M08	71.99	-157.19	86	52.4	55.3	2	22442	5				
Arctic Eis 12	2012	M08	71.99	-157.19	86	53.0	48.0	2	15099	5				
Arctic Eis 12	2012	M08	71.99	-157.19	86	46.3	69.9	3	35614	6				
Arctic Eis 12	2012	N01	72.50	-168.46	53	58.1	46.4	2	21759	5				
Arctic Eis 12	2012	N01	72.50	-168.46	53	51.3	60.8	2	10590	5				
Arctic Eis 12	2012	N04	72.50	-163.51	47	51.8	54.9	2	18744	5				
Arctic Eis 12	2012	N04	72.50	-163.51	47	50.4	45.3	2	17651	5				
Arctic Eis 12	2012	N05	72.50	-161.93	42	45.4	35.1	2	10353	6				
Arctic Eis 12	2012	N05	72.50	-161.93	42	49.3	45.0	2	19579	5				
Arctic Eis 12	2012	N05	72.50	-161.93	42	62.7	81.9	2	30189	6				
Arctic Eis 12	2012	N06	72.48	-160.22	46	44.3	33.5	2	12203	5				
Arctic Eis 12	2012	N06	72.48	-160.22	46	49.8	46.3	2	16223	5				
BeauFish 2011	2011	WB28	71.68	-155.16	180	64.1	96.0	2	31923	5	0.121	0.049	2	3
BeauFish 2011	2011	CB27	71.21	-149.85	180	62.3	96.0	2	33981	5	0.316	0.243	3	4
BeauFish 2011	2011	WB32	71.73	-153.49	80		105.0	2	53531	6	0.282	0.175	3	3
BeauFish 2011	2011	CB28	71.25	-150.42	180	61.7	125.0	2	37143	5	0.156	0.081	2	3
BeauFish 2011	2011	WB28	71.68	-155.16	180	51.8	54.0	2	18267	5	0.087	0.044	2	2
Comida 2010	2010	9	70.83	-167.79	52	54.6	53.2	2	22717	6	0.062	0.009	1	1
Comida 2010	2010	35	71.67	-166.92	47	42.9	27.3	2	11107	5	0.057	0.025	1	1
Comida 2010	2010	5	70.40	-164.48	42				17297		0.083	0.048	2	2
Comida 2010	2010	19	71.03	-166.95	46	50.4	42.9	2	17500	5	0.057	0.012	1	1
Comida 2010	2010	20	71.21	-168.31	20	47.5	37.9	2	16917	6	0.071	0.015	1	1
Comida 2010	2010	35	71.67	-166.92	47	52.9	51.1	2	20625	6	0.066	0.009	1	1

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
Comida 2010	2010	21	71.48	-167.78	49	62.9	81.6	2	37250	6	0.083	0.010	1	1
Comida 2010	2010	21	71.48	-167.78	49	52.7	50.1	3	22250	6	0.081	0.037	2	2
Comida 2010	2010	22	71.27	-167.01	47	51.0	43.7	2	18600	5	0.053	0.009	1	1
Comida 2010	2010	20	71.21	-168.31	20	57.8	64.5	2	28821	5	0.151	0.109	3	3
Comida 2010	2010	21	71.48	-167.78	49	52.6	40.2	2	23404	5	0.051	0.009	1	1
Comida 2010	2010	9	70.83	-167.79	52	52.3	40.5	2	27750	6	0.087	0.048	2	2
Comida 2010	2010	1013	71.93	-162.67	41	60.2	73.0	2	34300	5	0.078	0.002	1	1
Comida 2010	2010	35	71.67	-166.92	47	47.6	39.2	2	18450	6	0.042	0.005	1	1
Comida 2010	2010	22	71.27	-167.01	47	52.6	49.2	2	20464	5	0.059	0.003	1	1
Comida 2010	2010	108	72.10	-162.98	38	38.7	20.4	2	9333	5	0.030	0.005	1	1
Comida 2010	2010	22	71.27	-167.01	47	56.5	60.9	2	25683	5	0.070	0.003	1	1
Comida 2010	2010	107	70.09	-166.46	46	51.4	41.9	2	22788	5	0.099	0.029	1	1
Comida 2010	2010	20	71.21	-168.31	20	40.3	18.2	2	21500	6	0.047	0.016	1	1
Comida 2010	2010	10	70.67	-167.08	52	46.4	38.0	2	15558	5	0.057	0.008	1	1
Comida 2010	2010	37	72.05	-166.34	47	47.1	30.7	2	10654	5	not found			
Comida 2010	2010	10	70.67	-167.08	52	49.7	40.8	2	14633	5	0.087	0.057	2	3
Comida 2010	2010	22	71.27	-167.01	47	42.5	27.2	2	12192	4	0.044	0.004	1	1
Comida 2010	2010	107	70.09	-166.46	46	54.9	62.8	2	25516	6	0.076	0.004	1	1
Comida 2010	2010	19	71.03	-166.95	46		22.7	2	8679	5	0.045	0.029	2	2
Comida 2010	2010	35	71.67	-166.92	47	56.0	56.1	2	27018	6	0.081	0.003	1	1
Comida 2010	2010	9	70.83	-167.79	52	52.0	46.1	2	22429	6	0.077	0.018	1	1
Comida 2010	2010	20	71.21	-168.31	20	53.0	52.6	2	11242	6	0.080	0.014	1	1
Comida 2010	2010	107	70.09	-166.46	46	50.8	49.3	2	22192	5	0.062	0.008	1	1
Comida 2010	2010	35	71.67	-166.92	47	51.5	45.4	2	17867	5	0.063	0.007	1	1
Comida 2010	2010	107	70.09	-166.46	46	49.6	49.6	2	18000	5	0.194	0.128	2	2
Comida 2010	2010	37	72.05	-166.34	47	55.4	55.0	2	10179	6	0.074	0.019	1	1
Comida 2010	2010	21	71.48	-167.78	49	52.4	52.2	2	26058	6	0.048	0.017	1	1
Comida 2010	2010	21	71.48	-167.78	49	55.1	55.2	2	26923	6	0.052	0.001	1	1

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
Comida 2010	2010	10	70.67	-167.08	52	51.6	47.9	2	16694	6	0.079	0.029	2	2
Comida 2010	2010	21	71.48	-167.78	49	52.1	49.5	2	22917	6	0.057	0.005	1	1
Comida 2010	2010	38	71.93	-165.16	38	45.2	37.6	3	13404	5	0.144	0.110	3	3
Comida 2010	2010	20	71.21	-168.31	20	52.9	50.0	2	23450	5	0.055	0.007	1	1
Comida 2010	2010	37	72.05	-166.34	47	43.1	29.0	2	27483	5	0.077	0.006	1	1
Comida 2010	2010	37	72.05	-166.34	47	43.1	25.9	2		5	0.054	0.005	1	1
Comida 2010	2010	22	71.27	-167.01	47	56.5	59.2	2	26911	5	0.069	0.003	1	1
Comida 2010	2010	22	71.27	-167.01	47	45.2	33.0	2	13038	5	0.074	0.017	1	1
Comida 2010	2010	35	71.67	-166.92	47	43.8	28.2	2	11365	5	0.043	0.014	1	1
Comida 2010	2010	38	71.93	-165.16	38	46.8	36.5	2	16192	5	0.047	0.018	1	1
Comida 2010	2010	10	70.67	-167.08	52	50.2	42.9	2	20231	6	0.091	0.003	1	1
Comida 2010	2010	19	71.03	-166.95	46	61.7	60.4	2	30563	6	0.148	0.076	2	3
Comida 2010	2010	9	70.83	-167.79	52	48.5	37.8	2	17517	6	0.048	0.004	1	1
Comida 2010	2010	10	70.67	-167.08	52	44.2	28.8	2	12054	5	0.140	0.111	3	3
Comida 2010	2010	19	71.03	-166.95	46	55.5	53.9	2	23518	5	0.069	0.012	1	1
Comida 2010	2010	10	70.67	-167.08	52	48.6	37.7	2	18446	6	0.048	0.004	1	1
Comida 2010	2010	9	70.83	-167.79	52	54.6	53.2	2	11734	6	0.076	0.044	2	3
Comida 2010	2010	19	71.03	-166.95	46	45.1	28.2	2	12107	5	0.038	0.008	1	1
Comida 2010	2010	36	71.93	-165.39	50	54.9	52.8	2	27077	6	0.067	0.002	1	1
Comida 2010	2010	36	71.93	-165.39	50	50.9	44.9	2	22250	5				
Comida 2010	2010	36	71.93	-165.39	50	50.6	39.5	2	17788	5	0.061	0.037	2	3
Comida 2010	2010	9	70.83	-167.79	52	44.3	27.0	2	13558	6	0.066	0.041	2	2
Comida 2010	2010	107	70.09	-166.46	46	48.3	39.9	2	17214	5	0.080	0.024	1	1
Comida 2010	2010	36	71.93	-165.39	50	53.7	52.5	2	23089	6	0.059	0.002	1	1
Comida 2010	2010	36	71.93	-165.39	50	53.1	54.5	2	25083	6	0.048	0.001	1	1
Comida 2010	2010	19	71.03	-166.95	46	52.4	53.0	4	27031	6	0.126	0.039	2	?
Comida 2010	2010	9	70.83	-167.79	52	44.1	26.4	2	11865	6	0.107	0.085	3	4
CSESP 2010	2010	KF017	71.02	-165.64	40.4	51.2	45.5	2	17850	5	0.059	0.009	1	1

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
CSESP 2010	2010	KF021	71.14	-166.03		50.1	46.0	2	17071	6	0.052	0.015	1	1
CSESP 2010	2010	KF021	71.14	-166.03		49.0	42.2	2	11089	6	0.043	0.005	1	1
CSESP 2010	2010	KF021	71.14	-166.03		47.6	38.5	2	14547	6	0.051	0.010	1	1
CSESP 2010	2010	KF017	71.02	-165.64	40.4	53.5	49.5	2	20000	5	0.059	0.009	1	1
CSESP 2010	2010	KF021	71.14	-166.03		55.2	55.8	2	20594	5	0.061	0.005	1	1
CSESP 2010	2010	KF021	71.14	-166.03		40.7	21.7	2	8308	5	0.037	0.002	1	1
CSESP 2010	2010	KF021	71.14	-166.03		52.5	50.6	2	18333	5	0.061	0.011	1	1
CSESP 2010	2010	KF021	71.14	-166.03		50.1	50.2	2	19036	6	0.050	0.006	1	1
CSESP 2010	2010	KF017	71.02	-165.64	40.4	53.2	51.4	2	20875	5	0.064	0.012	1	1
CSESP 2010	2010	KF017	71.02	-165.64	40.4	57.1	69.4	3	42078	6	0.114	0.048	1	1
CSESP 2010	2010	36	71.93	-165.39	50	49.2	40.0	2	16200	6	0.025	0.008	1	1
CSESP 2010	2010	KF017	71.02	-165.64	40.4	46.3	37.6	2	14250	5	0.028	0.002	1	1
CSESP 2010	2010	KF021	71.14	-166.03		54.8	56.0	2	18147	6	0.056	0.019	1	1
CSESP 2010	2010	KF003	70.65	-165.25	39.8	54.3	54.0	2	24217	6	0.073			
CSESP 2010	2010	KF017	71.02	-165.64	40.4	47.7	37.8	2	14804	5	0.048	0.004	1	1
CSESP 2010	2010	KF021	71.14	-166.03		50.1	49.5	2	16467	6	0.050	0.015	1	1
CSESP 2010	2010	KF021	71.14	-166.03		48.6	41.7	2	13633	6	0.056	0.022	1	1
CSESP 2010	2010	KF021	71.14	-166.03		47.4	41.1	2	13500	6	0.060	0.005	1	1
CSESP 2010	2010	KF017	71.02	-165.64	40.4	54.2	55.7	2	22429	6	0.076	0.013	1	1
CSESP 2010	2010	KF017	71.02	-165.64	40.4	48.2	39.3	2	15696	5	0.060	0.040	2	2
CSESP 2010	2010	SF014	71.87	-164.55	37.6	41.3	24.8	2	11538	5	0.043	0.002	1	1
CSESP 2010	2010	KF021	71.14	-166.03		47.9	40.8	2	14365	6	0.053	0.027	2	2
CSESP 2010	2010	KF021	71.14	-166.03		48.8	36.3	2	17423	6	0.064	0.017	1	1
CSESP 2010	2010	SF007	71.75	-164.96	37.6	47.9	37.9	2	22083	?	0.042	0.006	1	1
CSESP 2010	2010	SF020	71.99	-164.15	36.3	38.7	22.8	2	9558	5	0.034	0.005	1	1
CSESP 2010	2010	KF021	71.14	-166.03		42.9	29.5	2	12346	5	0.098	0.080	2	3
CSESP 2010	2010	KF021	71.14	-166.03		47.4	35.8	2	18804	6	0.040	0.004	1	1
CSESP 2010	2010	KF021	71.14	-166.03		47.0	37.8	3	18615	6	0.185	0.157	3	3

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
CSESP 2010	2010	KF021	71.14	-166.03		45.9	37.1	2	13578	6	0.046	0.020	1	1
CSESP 2010	2010	KF021	71.14	-166.03		45.8	35.5	2	15786	6	0.044	0.003	1	1
CSESP 2010	2010	KF021	71.14	-166.03		47.6	38.6	2	14067	6	0.044	0.022	1	1
CSESP 2010	2010	KF021	71.14	-166.03		48.4	40.0	2	13214	6	0.048	0.010	1	1
CSESP 2010	2010	KF021	71.14	-166.03		50.1	41.0	2	16167	5	0.049	0.015	1	1
CSESP 2010	2010	KF021	71.14	-166.03		50.0	43.2	2	20107	6	0.065	0.005	1	1
CSESP 2010	2010	KF021	71.14	-166.03		52.6	56.4	2	27232	6	0.060	0.004	1	1
CSESP 2010	2010	KF021	71.14	-166.03		41.3	25.7	2	11692	6	0.034			
CSESP 2010	2010	KF021	71.14	-166.03		49.2	40.8	2	17607	5	0.045	0.003	1	1
CSESP 2010	2010	KF021	71.14	-166.03		58.4	73.0	2	26567	6	0.049	0.001	1	1
CSESP 2010	2010	KF021	71.14	-166.03		49.2	39.8	2	13600	6	0.048	0.024	2	2
CSESP 2010	2010	KF021	71.14	-166.03		49.9	40.2	2	15518	5	0.046	0.027	2	2
RUSALCA 2009	2009	CEN5	69.68	-174.84	54	47.4	37.1	2	19536	6	0.041			
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	38.9	17.1	2	8425	5	0.052	0.041	2	2
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	42.4	20.7	1	9542	6	0.056	0.028	2	2
RUSALCA 2009	2009	CEN5	69.68	-174.84	54	48.4	30.5	2	16827	6	0.037			
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	40.1	18.0	2	11477	6	0.049	0.025	2	1
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	37.9	13.6	1	5654	5	0.044	0.031	2	3
RUSALCA 2009	2009	HC49	73.34	-175.57	147	52.2	34.0	2	4946	?	not found			
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	43.8	28.9	2	11771	6	0.028			
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	42.2	21.2	2	12833	6	0.042	0.015	1	1
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	40.0	18.2	1	9958	6	0.070	0.049	2	3
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	45.2	29.9	2	10979	5	0.058	0.036	2	3
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	43.5	22.3	2	13958	5	0.054	0.032	2	2
RUSALCA 2009	2009	CEN5	69.68	-174.84	54	52.4	40.4	3	22900	6	0.044	0.008	1	1
RUSALCA 2009	2009	CEN5	69.68	-174.84	54	50.4	45.2	3	20172	6	0.045	0.006	1	1
RUSALCA 2009	2009	CEN5	69.68	-174.84	54	47.8	38.4	2	18400	6	0.097	0.062	2	2
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	39.5	18.3	2	6167	6	0.067	0.041	2	3

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
RUSALCA 2009	2009	HC49	73.34	-175.57	147	49.0	38.6	2	21135	6	0.080	0.005	1	1
RUSALCA 2009	2009	CEN5	69.68	-174.84	54	51.6	39.7	2	23458	5	0.036	0.002	1	1
RUSALCA 2009	2009	CEN3	70.29	-176.67	57	40.4	20.6	1	9250	6	0.039	0.021	2	2
RUSALCA 2009	2009	CL6	68.51	-171.47	55	45.0	33.1	3	11904	5	0.032	0.003	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	55.3	59.6	2	26821	6	0.005	0.003	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	59.6	68.8	2	38654	6	0.061	0.014	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	48.3	35.5	2	16795	6	0.070	0.046	2	2
RUSALCA 2009	2009	CL6	68.51	-171.47	55	52.9	52.7	2	22071	6	0.054			
RUSALCA 2009	2009	CL6	68.51	-171.47	55	54.7	49.7	3	24125	6	0.079	0.010	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	57.3	66.7	2	27633	5	0.068	0.001	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	52.5	48.6	2	22717	6	0.062	0.002	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	47.4	37.9	2	14391	6	0.081	0.029	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	46.5	35.1	2	16089	6	0.045	0.007	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	42.1	25.2	2	10712	5	0.057	0.008	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	48.7	42.9	3	18563	6	0.047			
RUSALCA 2009	2009	CL6	68.51	-171.47	55	47.1	33.0	2	12938	5	0.047	0.005	1	1
RUSALCA 2009	2009	CL8	67.87	-172.55	50	52.9	54.2	2	24483	6	0.056	0.004	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55	54.5	54.3	2	24203	6	0.077	0.003	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50	47.8	35.1	2	6226	5	0.042	0.004	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50	48.4	35.8	2	12696	6	0.043	0.005	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50				17133		0.046			
RUSALCA 2009	2009	CL6	68.51	-171.47	55	55.6	62.2	2	29857	6	0.070	0.007	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50				23633		0.146	0.063	2	2
RUSALCA 2009	2009	CL3	69.00	-166.92	50	43.8	28.1	2	17731	6	0.059	0.008	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55				27406					
RUSALCA 2009	2009	CL3	69.00	-166.92	50				15804		0.040	0.003	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50	44.5	27.7	2	6538	4	0.064	0.022	2	2
RUSALCA 2009	2009	CL3	69.00	-166.92	50				15375		0.068	0.016	1	1

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
RUSALCA 2009	2009	CL6	68.51	-171.47	55	54.6	55.2	2	21984	6	0.064	0.006	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50				24519		not found			
RUSALCA 2009	2009	CL3	69.00	-166.92	50	46.2	34.3	2	9750	5	0.105	0.078	2	2
RUSALCA 2009	2009	CL3	69.00	-166.92	50	46.3	31.9	2	14135	5	0.071	0.023	1	1
RUSALCA 2009	2009	CL8	67.87	-172.55	50	49.3	43.4	2	21365	6	0.047			
RUSALCA 2009	2009	CL3	69.00	-166.92	50				26071		0.150	0.093	1	1
RUSALCA 2009	2009	CL6	68.51	-171.47	55				15383					
RUSALCA 2009	2009	CL3	69.00	-166.92	50				19288		0.051	0.012	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50				9393		0.126	0.105	3	4
RUSALCA 2009	2009	CL3	69.00	-166.92	50	49.0	39.1	2	17442	6	0.044	0.002	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50	49.4	36.6		13536	5	0.062	0.021	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50	54.1	49.7	2	20446	5	0.038	0.004	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50				21297		0.057	0.005	1	1
RUSALCA 2009	2009	CL3	69.00	-166.92	50				14021		0.078	0.018	1	1
RUSALCA 2009	2009	CL8	67.87	-172.55	50	47.0	38.1	2	18018	5	0.032			
RUSALCA 2009	2009					46.5	37.0	2	6979	6	0.042	0.001	1	1
RUSALCA 2009	2009		68.30	-167.04	38	50.1	38.7	2	14549	6	0.051	0.003	1	1
RUSALCA 2009	2009		68.30	-167.04	38	53.8	47.3	2	8833	5				
RUSALCA 2009	2009		68.30	-167.04	38	50.2	36.2	2	16326	6	0.040	0.001	1	1
RUSALCA 2009	2009		68.30	-167.04	38	42.8	27.9	3	10130					
RUSALCA 2009	2009		68.30	-167.04	38	48.9	40.2	2	17230	5				
RUSALCA 2009	2009		68.30	-167.04	38	48.3	42.7	2	17265	6				
RUSALCA 2009	2009		68.30	-167.04	38	54.1	56.9	2	21970	6				
RUSALCA 2009	2009		68.30	-167.04	38	54.1	52.6	2	16783	6				
RUSALCA 2009	2009		68.30	-167.04	38	52.8	47.4	2	15065	5				
RUSALCA 2009	2009		68.30	-167.04	38	44.7	32.9	2	14787	6				
RUSALCA 2009	2009		68.30	-167.04	38	47.9	36.9	2	11340	5				
RUSALCA 2009	2009		68.30	-167.04	38	45.8	33.4	2	17332	5				

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
RUSALCA 2009	2009		68.30	-167.04	38	43.6	34.2	3	9244	6				
RUSALCA 2009	2009		68.30	-167.04	38	57.3	58.3	3	25909	5				
RUSALCA 2009	2009		68.30	-167.04	38	45.9	37.0	2	18864	5	0.074	0.035	1	1
RUSALCA 2009	2009		68.30	-167.04	38	52.4	53.3	2	26825	6	0.048	0.004	1	1
RUSALCA 2009	2009		68.30	-167.04	38	47.1	36.3	2	23495	6	0.027	0.007	1	1
RUSALCA 2009	2009		68.30	-167.04	38	49.3	43.0	3	10711	5	0.046	0.016	1	1
RUSALCA 2009	2009		68.30	-167.04	38	48.7	43.2	2	19140	6	not found			
RUSALCA 2009	2009		68.30	-167.04	38	47.9	38.3	2	15606	6	0.039	0.008	1	1
RUSALCA 2009	2009		68.30	-167.04	38	51.9	48.7	2	13959	5	0.058	0.003	1	1
RUSALCA 2009	2009		68.30	-167.04	38	50.2	47.5	2	18541	6	0.047	0.002	1	1
RUSALCA 2009	2009		68.30	-167.04	38	52.7	55.0	3	22030	5	0.111	0.084	2	2
RUSALCA 2009	2009		68.30	-167.04	38	51.6	50.2	2	15006	5	0.060	0.001	1	1
RUSALCA 2009	2009		68.30	-167.04	38	51.6	54.5	2	15209	6	0.053	0.008	1	1
RUSALCA 2009	2009		68.30	-167.04	38	48.8	42.3	2	18316	5	0.045	0.004	1	1
RUSALCA 2009	2009		68.30	-167.04	38	45.5	32.2	2	13265	5	0.061	0.009	1	1
RUSALCA 2009	2009		68.30	-167.04	38	51.0	47.3	3	20138	5	0.049	0.003	1	1
RUSALCA 2009	2009		68.30	-167.04	38	53.7	50.4	3	26990	6	0.038	0.002	1	1
RUSALCA 2009	2009		68.30	-167.04	38	51.4	46.4	2	20798	6	0.072	0.014	1	1
RUSALCA 2009	2009		68.30	-167.04	38	50.3	39.1	2	12836	6	0.105	0.033	2	2
RUSALCA 2009	2009		68.30	-167.04	38	48.5	60.2	2	7265	6	0.050	0.006	1	1
RUSALCA 2009	2009		68.30	-167.04	38	55.7	55.0	3	24127	6	0.060	0.014	1	1
RUSALCA 2009	2009		68.30	-167.04	38	52.1	56.4	3	14815	5	0.039	0.004	1	1
RUSALCA 2009	2009		68.30	-167.04	38	52.0	36.0	3	46793	5				
RUSALCA 2009	2009		68.30	-167.04	38	45.4	56.9	2	14775	5	0.119	0.099	3	3
RUSALCA 2009	2009		68.30	-167.04	38	55.9	27.0	2	21911	5	0.091	0.051	2	2
RUSALCA 2009	2009		68.30	-167.04	38	42.3	27.0	3	11151	5				
RUSALCA 2009	2009		68.51	-171.47	55	27.7	6.5	2	21922		0.053	0.027	2	2
RUSALCA 2009	2009		68.51	-171.47	55	53.5	50.7	3	8316	6	0.046	0.011	1	1

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
RUSALCA 2012	2012		68.30	-167.04	38	50.3	38.0	2	13121	5				
RUSALCA 2012	2012		69.02	-168.84	54	50.8	61.0	3	27472	6	0.069	0.030	2	2
RUSALCA 2012	2012		69.02	-168.84	54	47.2	46.0	3	23396	6	0.050	0.031	2	2
RUSALCA 2012	2012		69.02	-168.84	54	47.5	47.0	4	10443	4	0.122	0.075	3	3
RUSALCA 2012	2012		69.02	-168.84	54	45.3	42.0	3	21262	6	0.062	0.016	1	1
RUSALCA 2012	2012		69.02	-168.84	54	43.3	48.0	4	13419	4	0.048	0.013	1	1
RUSALCA 2012	2012		69.02	-168.84	54	50.8	65.0	4	25123	6	0.093	0.057	3	3
RUSALCA 2012	2012		69.02	-168.84	54	46.6	58.0	4	15358	5	0.061	0.032	2	2
RUSALCA 2012	2012		69.02	-168.84	54	52.2	64.0	4	24423	6	0.084	0.036	2	2
RUSALCA 2012	2012		69.02	-168.84	54	43.7	39.0	4	15058	6	0.074	0.046	2	3
RUSALCA 2012	2012		69.02	-168.84	54	56.2	73.0	3	25024	6				
RUSALCA 2012	2012		69.02	-168.84	54	44.4	52.0	4	12531	5				
RUSALCA 2012	2012		69.02	-168.84	54	41.5	35.0	3	13760	6				
RUSALCA 2012	2012		69.02	-168.84	54	43.8	33.0	4	14474	6				
RUSALCA 2012	2012		69.02	-168.84	54	41.9	28.0	4	34426	6				
RUSALCA 2012	2012		69.02	-168.84	54	49.2	44.0	3	13092	5				
RUSALCA 2012	2012		69.02	-168.84	54	52.5	57.0	3	12610	6				
RUSALCA 2012	2012		69.02	-168.84	54	57.7	74.0	2	9922	5				
RUSALCA 2012	2012		69.02	-168.84	54	45.5	36.0	4	18873	6				
RUSALCA 2012	2012		69.02	-168.84	54	52.9	60.0	4	15152	6				
RUSALCA 2012	2012		67.87	-172.61	50	54.1	58.0	2	3455	5				
RUSALCA 2012	2012		67.87	-172.61	50	51.6	51.0	2	17994	5				
RUSALCA 2012	2012		67.87	-172.61	50	49.7	43.0	2	17407	5	0.025		empty	
RUSALCA 2012	2012		67.87	-172.61	50	49.3	44.0	2	18698	5	0.031		empty	
RUSALCA 2012	2012		67.87	-172.61	50	49.2	45.0	2	13909	4				
RUSALCA 2012	2012		67.87	-172.61	50	45.4	45.0	3	28192	5				
RUSALCA 2012	2012		67.86	-168.27	58	56.4	74.0	4			0.116	0.039	1	1
RUSALCA 2012	2012		67.86	-168.27	58	54.4	66.0	3	30268		0.109	0.029	1	1

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
RUSALCA 2012	2012		67.86	-168.27	58	54.4	57.0	3	32094		0.130	0.061	2	3
RUSALCA 2012	2012		67.86	-168.27	58	56.7	66.0	3	33546		0.070	0.023	1	1
RUSALCA 2012	2012		67.86	-168.27	58	46.8	49.0	4	21896		0.066	0.037	2	2
RUSALCA 2012	2012		67.86	-168.27	58	53.2	51.0	3	24558					
RUSALCA 2012	2012		70.96	-173.98	52	47.8	40.6	3	17295	6				
RUSALCA 2012	2012		70.96	-173.98	52	38.5	22.0	2	10833	6				
RUSALCA 2012	2012		70.96	-173.98	52	44.7	34.0	2	8524	5				
RUSALCA 2012	2012		70.97	-173.98	53	57.6	72.0	4	32266	6				
RUSALCA 2012	2012		70.97	-173.98	53	42.1	27.0	2	8166	5				
RUSALCA 2012	2012		70.97	-173.98	53	45.0	31.0	2	13439	5				
RUSALCA 2012	2012		70.97	-173.98	53	43.2	31.0	2	11252	5				
RUSALCA 2012	2012		70.97	-173.98	53	45.8	35.0	2	11735	4				
RUSALCA 2012	2012		70.97	-173.98	53	45.0	31.0	2	15385	4				
RUSALCA 2012	2012		70.97	-173.98	53	44.2	31.0	2	16526	5				
RUSALCA 2012	2012		70.97	-173.98	53	46.1	34.0	2	5034	5				
RUSALCA 2012	2012		70.97	-173.98	53	44.6	29.0	2	9881	5				
RUSALCA 2012	2012		70.97	-173.98	53	40.0	25.0	2	4023	5				
RUSALCA 2012	2012		70.90	-175.00	70	45.0	34.0	2	9235	4				
RUSALCA 2012	2012		70.90	-175.00	70	45.0	34.0	2	12133	5				
RUSALCA 2012	2012		70.90	-175.00	70	43.6	30.0	2	10082	5				
RUSALCA 2012	2012		70.90	-175.00	70	39.6	24.0	2	6449	5				
RUSALCA 2012	2012		70.90	-175.00	70	43.9	30.0	2	8812	4				
RUSALCA 2012	2012		70.90	-175.00	70	40.6	26.0	2	10199	5				
RUSALCA 2012	2012		70.90	-175.00	70	38.6	22.0	2	5455	5				
RUSALCA 2012	2012		70.90	-175.00	70	38.7	21.0	2	5781	6				
RUSALCA 2012	2012		70.90	-175.00	70	40.6	25.0	2	6782	5				
RUSALCA 2012	2012		70.90	-175.00	70	44.8	33.0	2	11454	5				
RUSALCA 2012	2012		71.71	-174.91	73	40.7	23.0	2	6194	4	0.047	0.015	1	1

Cruise	Year	Station	Lat °N	Long °W/E	Water depth (m)	CW (mm)	Wet weight (g)	Shell condition	Number of eggs	Clutch fullness	Spermatheca weight (g ww)	Spermatheca load weight (g ww)	Fullness index	Number of layers in Spermatheca
RUSALCA 2012	2012		71.71	-174.91	73	42.4	27.0	2	11073	5	0.029	0.003	1	1
RUSALCA 2012	2012		70.90	-175.00	70	41.0	23.0	2	8723	5				
RUSALCA 2012	2012		70.90	-175.00	70	42.6	26.0	2	7020	4				
RUSALCA 2012	2012		70.90	-175.00	70	47.1	38.0	2		5				
RUSALCA 2012	2012		70.90	-175.00	70	43.1	27.0	2		4				
RUSALCA 2012	2012		71.79	-174.35	57	46.1	40.0	2	13239	5	0.055	0.005	1	1
RUSALCA 2012	2012		71.79	-174.35	57	42.3	33.0	3	9951	5	0.053		empty	
RUSALCA 2012	2012		71.79	-174.35	57	49.6	41.0	2	15556	5	0.055	0.017	1	1
RUSALCA 2012	2012		71.79	-174.35	57	47.1	40.0	2	11550	5				
RUSALCA 2012	2012		71.79	-174.35	57	41.2	28.1	2	10122					
RUSALCA 2012	2012		70.90	-175.00	70	43.9	33.0	2	12289	5				
RUSALCA 2012	2012		70.90	-175.00	70	48.9	38.0	1	11235	4				
RUSALCA 2012	2012		70.90	-175.00	70	38.0	21.0	2	8529	5				
RUSALCA 2012	2012		71.71	-174.91	73	47.0	40.0	2	4248					
RUSALCA 2012	2012		71.03	-175.99	50	41.2	24.0	2	6588	5				
RUSALCA 2012	2012		71.03	-175.99	50	40.0	26.0	2	7212	5				
Transboundary 12	2012		71.31	-150.67	500	72.2	148.0	2	58251	5				

Appendix III: Stable Isotope Data

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
Arctic Eis	2012	SCF02	SC	37	9.37	28.30	imm female	40	15.50	18.68
Arctic Eis	2012	SCC03	SC	24	8.64	29.18	imm female	40	15.64	18.66
Arctic Eis	2012	SCC03	SC	24	8.64	29.18	imm female	40	13.43	18.59
Arctic Eis	2012	SCC03	SC	24	8.64	29.18	imm female	40	14.12	18.22
Arctic Eis	2012	SCC03	SC	24	8.64	29.18	imm female	40	14.58	18.61
Arctic Eis	2012	SCD01	SC	47	3.83	30.36	imm female	40	12.85	16.56
Arctic Eis	2012	SCA02	SC	15	10.30	25.67	imm female	40	14.19	18.26
Arctic Eis	2012	SCB01	SC	52	1.46	32.31	imm female	40	14.52	17.38
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	imm female	40	14.19	18.26
Arctic Eis	2012	SCA02	SC	15	10.30	25.67	imm female	40	14.29	18.50
Arctic Eis	2012	SCC04	SC	27	8.91	29.20	imm female	40	13.60	18.92
Arctic Eis	2012	SCC04	SC	27	8.91	29.20	imm female	40	14.12	18.22
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	imm female	40	14.08	18.93
Arctic Eis	2012	SCD02	SC	46	4.73	28.51	imm female	40	14.56	17.80
Arctic Eis	2012	SCH02	SC	47	7.89	30.16	imm female	40	15.70	18.95
Arctic Eis	2012	SCD02	SC	46	4.73	28.51	imm female	40	15.21	17.09
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	imm female	40	15.09	18.50
Arctic Eis	2012	NCM03	NC	42	1.37	29.26	imm female	40	14.40	18.55
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	imm female	40	14.27	18.54
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	imm female	40	14.98	18.57
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	imm female	40	16.84	18.98
Arctic Eis	2012	N5IF9	NC	42	1.64	29.44	imm female	40	14.603	18.63
Arctic Eis	2012	SCI03	SC	40	6.62	31.44	imm female	50	14.69	18.07
Arctic Eis	2012	SCC04	SC	27	8.91	29.20	imm female	50	14.60	18.72
Arctic Eis	2012	SCA01	SC	52	1.70	32.45	imm female	50	14.52	18.68
Arctic Eis	2012	SCC03	SC	24	8.64	29.18	imm female	50	15.01	18.46
Arctic Eis	2012	SCC04	SC	27	8.91	29.20	imm female	50	13.98	19.18
Arctic Eis	2012	SCA01	SC	52	1.70	32.45	imm female	50	14.57	18.20
Arctic Eis	2012	SCA01	SC	52	1.70	32.45	imm female	50	14.19	18.26
Arctic Eis	2012	SCA01	SC	52	1.70	32.45	imm female	50	15.19	17.46
Arctic Eis	2012	SCC02	SC	38	2.58	32.33	imm female	50	13.77	18.44
Arctic Eis	2012	SCB01	SC	52	1.46	32.31	imm female	50	15.34	17.95
Arctic Eis	2012	NCL06	NC	46	5.23	29.97	imm female	50	13.66	18.64
Arctic Eis	2012	NCJ04	NC	43	7.72	31.13	imm female	50	13.99	18.81
Arctic Eis	2012	NCM03	NC	42	1.37	29.26	imm female	50	14.06	18.37
Arctic Eis	2012	M2IF16	NC	47	3.12	30.42	imm female	50	14.775	18.42
Arctic Eis	2012	SCH02	SC	47	7.89	30.16	male	40	15.00	18.70
Arctic Eis	2012	SCC04	SC	27	8.91	29.20	male	40	14.50	18.39
Arctic Eis	2012	SCD03	SC	40	6.39	31.48	male	40	13.71	16.36
Arctic Eis	2012	SCD03	SC	40	6.39	31.48	male	40	15.22	18.00
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	40	15.10	18.20
Arctic Eis	2012	SCH03	SC	35	9.22	29.08	male	40	14.34	19.02
Arctic Eis	2012	SCC04	SC	27	8.91	29.20	male	40	14.84	18.53
Arctic Eis	2012	SCD03	SC	40	6.39	31.48	male	40	15.37	17.51

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
Arctic Eis	2012	SCF02	SC	37	9.37	28.30	male	40	14.79	18.65
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	40	16.03	18.26
Arctic Eis	2012	SCF02	SC	37	9.37	28.30	male	40	14.76	18.74
Arctic Eis	2012	SCD03	SC	40	6.39	31.48	male	40	13.71	16.36
Arctic Eis	2012	SCC03	SC	24	8.64	29.18	male	40	14.39	19.49
Arctic Eis	2012	SCD02	SC	46	4.73	28.51	male	40	14.58	17.84
Arctic Eis	2012	SCD02	SC	46	4.73	28.51	male	40	15.12	17.54
Arctic Eis	2012	NCK03	NC	41	3.04	30.96	male	40	14.98	18.94
Arctic Eis	2012	NCL02	NC	47	3.68	31.30	male	40	13.77	17.46
Arctic Eis	2012	NCM03	NC	42	1.37	29.26	male	40	13.93	18.97
Arctic Eis	2012	NCM03	NC	42	1.37	29.26	male	40	14.71	18.63
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	40	15.02	19.49
Arctic Eis	2012	NCJ03	NC	42	5.95	31.28	male	40	14.77	18.02
Arctic Eis	2012	NCM03	NC	42	1.37	29.26	male	40	14.18	18.72
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	40	15.92	19.05
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	male	40	14.59	18.38
Arctic Eis	2012	NCK03	NC	41	3.04	30.96	male	40	14.93	18.42
Arctic Eis	2012	NCL06	NC	46	5.23	29.97	male	40	13.45	18.14
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	male	40	14.34	18.53
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	40	13.62	18.47
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	40	16.39	18.67
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	40	15.65	18.95
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	male	40	15.62	18.77
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	40	14.56	19.15
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	40	14.73	18.02
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	40	14.88	18.35
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	40	14.13	19.37
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	50	16.24	18.31
Arctic Eis	2012	SCE02	SC	56	5.45	30.72	male	50	15.24	17.41
Arctic Eis	2012	SCB01	SC	52	1.46	32.31	male	50	14.04	17.41
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	50	15.55	16.60
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	50	14.44	17.98
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	50	15.10	18.20
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	50	13.80	18.73
Arctic Eis	2012	SCD01	SC	47	3.83	30.36	male	50	13.39	15.82
Arctic Eis	2012	SCI03	SC	40	6.62	31.44	male	50	13.74	18.59
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	50	15.55	16.60
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	50	15.77	19.27
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	50	16.21	17.44
Arctic Eis	2012	SCH03	SC	35	9.22	29.08	male	50	14.70	19.81
Arctic Eis	2012	SCC02	SC	38	2.58	32.33	male	50	15.40	18.09
Arctic Eis	2012	SCC02	SC	38	2.58	32.33	male	50	14.96	17.77
Arctic Eis	2012	SCC03	SC	24	8.64	29.18	male	50	15.64	19.08
Arctic Eis	2012	SCE02	SC	56	5.45	30.72	male	50	15.86	17.52

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
Arctic Eis	2012	SCF02	SC	37	9.37	28.30	male	50	14.41	18.45
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	50	14.40	18.79
Arctic Eis	2012	SCH03	SC	35	9.22	29.08	male	50	13.93	18.47
Arctic Eis	2012	SCH02	SC	47	7.89	30.16	male	50	14.58	18.66
Arctic Eis	2012	SCD01	SC	47	3.83	30.36	male	50	13.22	16.17
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	50	15.06	17.36
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	50	14.44	17.98
Arctic Eis	2012	SCI01	SC	42	3.81	28.82	male	50	15.80	17.50
Arctic Eis	2012	SCA01	SC	52	1.70	32.45	male	50	15.19	17.46
Arctic Eis	2012	SCA02	SC	15	10.30	25.67	male	50	14.35	18.73
Arctic Eis	2012	SCA02	SC	15	10.30	25.67	male	50	14.84	18.26
Arctic Eis	2012	SCD01	SC	47	3.83	30.36	male	50	14.67	18.46
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	50	14.52	17.17
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	50	16.24	18.31
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	50	17.17	19.68
Arctic Eis	2012	NCN05	NC	42	1.64	29.44	male	50	15.90	18.53
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	50	15.23	19.52
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	50	15.56	17.92
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	50	16.72	19.26
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	50	14.09	17.64
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	50	14.54	18.59
Arctic Eis	2012	NCK03	NC	41	3.04	30.96	male	50	14.74	17.80
Arctic Eis	2012	NCJ01	NC	39	4.11	31.64	male	50	15.49	18.10
Arctic Eis	2012	NCJ01	NC	39	4.11	31.64	male	50	14.70	18.44
Arctic Eis	2012	NCJ01	NC	39	4.11	31.64	male	50	14.93	18.11
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	50	13.96	18.44
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	male	50	14.22	18.67
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	50	17.27	19.56
Arctic Eis	2012	NCN05	NC	42	1.64	29.44	male	50	13.89	18.10
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	50	15.05	18.79
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	50	13.51	18.56
Arctic Eis	2012	NCJ04	NC	43	7.72	31.13	male	50	14.72	18.95
Arctic Eis	2012	NCM04	NC	39	-0.13	27.86	male	50	14.01	18.16
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	50	14.87	19.05
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	50	15.69	19.40
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	50	14.69	18.10
Arctic Eis	2012	NCL02	NC	47	3.68	31.30	male	50	14.63	17.78
Arctic Eis	2012	NCJ04	NC	43	7.72	31.13	male	50	13.70	19.30
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	50	14.87	18.16
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	male	50	14.37	18.81
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	50	15.75	19.39
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	50	14.35	19.19
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	50	16.25	18.66
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	50	14.79	19.16

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	50	12.41	20.62
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	50	15.18	17.40
Arctic Eis	2012	NCJ03	NC	42	5.95	31.28	male	50	14.02	18.04
Arctic Eis	2012	NCJ03	NC	42	5.95	31.28	male	50	14.29	17.65
Arctic Eis	2012	NCM04	NC	39	-0.13	27.86	male	50	13.87	18.02
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	50	14.35	17.82
Arctic Eis	2012	NCJ03	NC	42	5.95	31.28	male	50	15.10	17.70
Arctic Eis	2012	NCL06	NC	46	5.23	29.97	male	50	13.66	18.64
Arctic Eis	2012	NCL07	NC	50	3.91	30.02	male	50	13.98	18.26
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	50	14.73	19.35
Arctic Eis	2012	NCM08	NC	86	2.55	27.51	male	50	15.82	19.46
Arctic Eis	2012	SCE02	SC	56	5.45	30.72	male	60	16.08	17.00
Arctic Eis	2012	SCC02	SC	38	2.58	32.33	male	60	13.46	17.74
Arctic Eis	2012	SCH02	SC	47	7.89	30.16	male	60	14.92	19.05
Arctic Eis	2012	SCE02	SC	56	5.45	30.72	male	60	15.91	18.81
Arctic Eis	2012	SCH02	SC	47	7.89	30.16	male	60	15.55	17.76
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	60	15.72	17.29
Arctic Eis	2012	SCI03	SC	40	6.62	31.44	male	60	16.20	18.45
Arctic Eis	2012	SCE02	SC	56	5.45	30.72	male	60	15.86	17.52
Arctic Eis	2012	SCE02	SC	56	5.45	30.72	male	60	16.08	17.00
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	60	15.72	17.29
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	60	13.82	18.41
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	60	14.27	17.76
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	60	15.29	17.49
Arctic Eis	2012	SCI04	SC	31	8.46	30.82	male	60	14.60	18.60
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	60	14.52	17.17
Arctic Eis	2012	SCD01	SC	47	3.83	30.36	male	60	12.87	16.44
Arctic Eis	2012	SCH03	SC	35	9.22	29.08	male	60	13.74	19.18
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	60	14.69	17.11
Arctic Eis	2012	NCM02	NC	47	3.12	30.42	male	60	14.28	17.36
Arctic Eis	2012	NCN05	NC	42	1.64	29.44	male	60	15.22	18.83
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	60	14.18	17.83
Arctic Eis	2012	NCJ03	NC	42	5.95	31.28	male	60	14.17	17.67
Arctic Eis	2012	NCN05	NC	42	1.64	29.44	male	60	15.55	18.49
Arctic Eis	2012	NCJ01	NC	39	4.11	31.64	male	60	15.27	17.27
Arctic Eis	2012	NCL02	NC	47	3.68	31.30	male	60	14.63	17.78
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	60	13.68	18.16
Arctic Eis	2012	NCJ02	NC	50	5.09	31.98	male	60	14.73	18.02
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	60	13.77	18.13
Arctic Eis	2012	NCJ04	NC	43	7.72	31.13	male	60	14.72	18.95
Arctic Eis	2012	NCJ03	NC	42	5.95	31.28	male	60	14.39	17.57
Arctic Eis	2012	NCJ04	NC	43	7.72	31.13	male	60	14.21	18.76
Arctic Eis	2012	NCM06	NC	38	0.07	27.18	male	60	14.35	18.15
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	70	15.27	17.30

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
Arctic Eis	2012	SCE02	SC	56	5.45	30.72	male	70	14.62	16.88
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	70	15.70	17.48
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	70	17.13	17.06
Arctic Eis	2012	SCB01	SC	52	1.46	32.31	male	70	14.81	18.58
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	70	13.95	16.87
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	70	15.85	16.88
Arctic Eis	2012	SCH02	SC	47	7.89	30.16	male	70	15.21	17.46
Arctic Eis	2012	SCH02	SC	47	7.89	30.16	male	70	15.07	18.43
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	70	15.03	17.48
Arctic Eis	2012	SCC02	SC	38	2.58	32.33	male	70	16.22	17.64
Arctic Eis	2012	SCH02	SC	47	7.89	30.16	male	70	14.70	18.76
Arctic Eis	2012	NCL01	NC	49	3.82	32.05	male	70	14.68	17.68
Arctic Eis	2012	NCL02	NC	47	3.68	31.30	male	70	13.57	17.75
Arctic Eis	2012	NCN01	NC	53	2.43	29.99	male	70	14.64	17.89
Arctic Eis	2012	SCI02	SC	47	5.54	31.12	male	80	16.10	17.68
Arctic Eis	2012	SCD03	SC	40	6.39	31.48	male	80	14.76	17.50
Arctic Eis	2012	SCG01	SC	51	4.22	30.87	male	80	15.34	16.96
Arctic Eis	2012	NCK03	NC	41	3.04	30.96	male	80	15.26	17.74
Arctic Eis	2012	M4NF1	NC	39	-0.13	27.86	mature female	30	14.117	18.39
Arctic Eis	2012	N7F3	NC	59	2.03	27.10	mature female	30	16.839	18.98
Arctic Eis	2012	J3F1	NC	42	5.95	31.28	mature female	30	14.983	18.07
Arctic Eis	2012	I1F17	SC	42	3.81	28.82	mature female	40	15.14	17.83
Arctic Eis	2012	E2F4	SC	56	5.45	30.72	mature female	40	13.72	16.76
Arctic Eis	2012	I1F16	SC	42	3.81	28.82	mature female	40	14.059	18.32
Arctic Eis	2012	I1F9	SC	42	3.81	28.82	mature female	40	14.475	19.51
Arctic Eis	2012	I1F6	SC	42	3.81	28.82	mature female	40	14.191	18.91
Arctic Eis	2012	I1F22	SC	42	3.81	28.82	mature female	40	15.713	18.11
Arctic Eis	2012	I1F4	SC	42	3.81	28.82	mature female	40	14.58	17.59
Arctic Eis	2012	I2F3	SC	47	5.54	31.12	mature female	40	14.042	17.65
Arctic Eis	2012	I2F19	SC	47	5.54	31.12	mature female	40	15.124	17.41
Arctic Eis	2012	J2F5	NC	50	5.09	31.98	mature female	40	14.469	18.11
Arctic Eis	2012	J3F3	NC	42	5.95	31.28	mature female	40	13.903	18.09
Arctic Eis	2012	J2F17	NC	50	5.09	31.98	mature female	40	14.829	18.73
Arctic Eis	2012	L7F22	NC	50	3.91	30.02	mature female	40	15.751	18.44
Arctic Eis	2012	L5F2	NC	44	1.72	29.49	mature female	40	14.85	18.22
Arctic Eis	2012	N7F1	NC	59	2.03	27.10	mature female	40	14.544	19.03
Arctic Eis	2012	N7F4	NC	59	2.03	27.10	mature female	40	15.276	20.30
Arctic Eis	2012	J4F3	NC	43	7.72	31.13	mature female	40	14.228	18.53
Arctic Eis	2012	J4F1	NC	43	7.72	31.13	mature female	40	13.553	18.31
Arctic Eis	2012	J4F2	NC	43	7.72	31.13	mature female	40	13.137	18.26
Arctic Eis	2012	J2F19	NC	50	5.09	31.98	mature female	40	14.797	17.89
Arctic Eis	2012	H2F3	SC	47	7.89	30.16	mature female	50	14.101	18.45
Arctic Eis	2012	E2F2	SC	56	5.45	30.72	mature female	50	13.965	17.91
Arctic Eis	2012	E2F1	SC	56	5.45	30.72	mature female	50	15.41	17.03

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
Arctic Eis	2012	E2F3	SC	56	5.45	30.72	mature female	50	14.294	17.64
Arctic Eis	2012	G1F1	SC	51	4.22	30.87	mature female	50	13.56	18.01
Arctic Eis	2012	G1F2	SC	51	4.22	30.87	mature female	50	14.106	18.32
Arctic Eis	2012	G1F3	SC	51	4.22	30.87	mature female	50	14.892	17.61
Arctic Eis	2012	G1F5	SC	51	4.22	30.87	mature female	50	15.143	17.18
Arctic Eis	2012	G1F6	SC	51	4.22	30.87	mature female	50	14.832	17.59
Arctic Eis	2012	H2F2	SC	47	7.89	30.16	mature female	50	14.925	18.46
Arctic Eis	2012	I2F9	SC	47	5.54	31.12	mature female	50	14.692	18.07
Arctic Eis	2012	I2F4	SC	47	5.54	31.12	mature female	50	14.869	18.35
Arctic Eis	2012	I2F19	SC	47	5.54	31.12	mature female	50	14.273	18.18
Arctic Eis	2012	I2F16	SC	47	5.54	31.12	mature female	50	15.243	18.54
Arctic Eis	2012	I1F8	SC	42	3.81	28.82	mature female	50	14.486	20.37
Arctic Eis	2012	I1F7	SC	42	3.81	28.82	mature female	50	14.954	18.46
Arctic Eis	2012	I2F5	SC	47	5.54	31.12	mature female	50	13.598	17.70
Arctic Eis	2012	I2F10	SC	47	5.54	31.12	mature female	50	15.41	18.28
Arctic Eis	2012	I3F1	SC	40	6.62	31.44	mature female	50	11.121	22.18
Arctic Eis	2012	H2F1	SC	47	7.89	30.16	mature female	50	13.975	18.54
Arctic Eis	2012	J2F9	NC	50	5.09	31.98	mature female	50	14.322	17.95
Arctic Eis	2012	N2F4	NC	50	3.26	30.50	mature female	50	15.816	17.49
Arctic Eis	2012	L2F6	NC	47	3.68	31.30	mature female	50	14.851	17.64
Arctic Eis	2012	M8F5	NC	86	2.55	27.51	mature female	50	15.873	18.11
Arctic Eis	2012	N7F2	NC	59	2.03	27.10	mature female	50	15.686	19.47
Arctic Eis	2012	M6F1	NC	38	0.07	27.18	mature female	50	14.791	18.61
Arctic Eis	2012	L5F1	NC	44	1.72	29.49	mature female	50	13.916	18.89
Arctic Eis	2012	J2F6	NC	50	5.09	31.98	mature female	50	8.032	18.17
Arctic Eis	2012	L7F19	NC	50	3.91	30.02	mature female	50	15.37	18.70
Arctic Eis	2012	J2F7	NC	50	5.09	31.98	mature female	50	15.875	18.47
Arctic Eis	2012	J2F10	NC	50	5.09	31.98	mature female	50	14.706	17.91
Arctic Eis	2012	J2F2	NC	50	5.09	31.98	mature female	50	13.928	17.75
Arctic Eis	2012	J2F1	NC	50	5.09	31.98	mature female	50	14.3	17.87
Arctic Eis	2012	J2F8	NC	50	5.09	31.98	mature female	50	13.734	18.00
Arctic Eis	2012	J2F20	NC	50	5.09	31.98	mature female	50	16.196	19.22
Arctic Eis	2012	J2F18	NC	50	5.09	31.98	mature female	50	15.398	17.78
Arctic Eis	2012	G1F4	SC	51	4.22	30.87	mature female	60	15.041	17.97
Arctic Eis	2012	I4F1	SC	31	8.46	30.82	mature female	60	15.473	18.84
Arctic Eis	2012	I2F8	SC	47	5.54	31.12	mature female	60	15.3	17.96
Arctic Eis	2012	I2F20	SC	47	5.54	31.12	mature female	60	14.415	19.94
Arctic Eis	2012	K1F1	NC	46	3.92	31.51	mature female	60	14.302	17.93
Arctic Eis	2012	J2F13	NC	50	5.09	31.98	mature female	60	14.48	17.75
BeauFish	2011	WB21	WB	45	4.83	31.39	imm female	30	13.37	18.81
BeauFish	2011	WB32	WB	80	1.09	31.96	imm female	30	15.19	17.13
BeauFish	2011	WB16	WB	62	2.38	31.85	imm female	40	14.87	18.34
BeauFish	2011	WB07	WB	180	-0.88	33.22	imm female	50	15.19	17.13
BeauFish	2011	WB32	WB	80	1.09	31.96	imm female	50	15.76	17.84

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
BeauFish	2011	CB34	CB	180	0.16	34.63	imm female	60	15.56	18.74
BeauFish	2011	CB28	CB	180	0.47	34.78	imm female	60	15.39	19.10
BeauFish	2011	CBX-500	CB	500	-0.16	34.49	imm female	70	15.24	18.95
BeauFish	2011	WB21	WB	45	4.83	31.39	male	30	13.06	18.19
BeauFish	2011	WB21	WB	45	4.83	31.39	male	30	14.15	18.61
BeauFish	2011	WB31	WB	180	-0.82	33.92	male	30	15.94	18.11
BeauFish	2011	WB21	WB	45	4.83	31.39	male	30	14.46	18.83
BeauFish	2011	WB26	WB	46	1.87	31.79	male	30	15.21	18.31
BeauFish	2011	WB26	WB	46	1.87	31.79	male	30	15.28	19.00
BeauFish	2011	WB16	WB	62	2.38	31.85	male	40	14.78	18.27
BeauFish	2011	WB32	WB	80	1.09	31.96	male	40	14.78	18.27
BeauFish	2011	WB24	WB	50	3.63	31.44	male	40	14.92	18.87
BeauFish	2011	WB21	WB	45	4.83	31.39	male	40	13.95	18.25
BeauFish	2011	WB21	WB	45	4.83	31.39	male	40	13.66	19.09
BeauFish	2011	WB20	WB	181	-0.86	33.17	male	40	11.71	21.20
BeauFish	2011	WB21	WB	45	4.83	31.39	male	40	14.28	18.22
BeauFish	2011	WB04	WB	180	-0.98	32.68	male	50	15.08	18.42
BeauFish	2011	WB16	WB	62	2.38	31.85	male	50	14.68	18.58
BeauFish	2011	WB13	WB	40	4.28	31.48	male	50	14.69	18.60
BeauFish	2011	WB13	WB	40	4.28	31.48	male	50	13.82	18.94
BeauFish	2011	WB13	WB	40	4.28	31.48	male	50	13.72	18.12
BeauFish	2011	WB13	WB	40	4.28	31.48	male	50	14.03	18.71
BeauFish	2011	WB26	WB	46	1.87	31.79	male	50	16.20	17.85
BeauFish	2011	WB20	WB	181	-0.86	33.17	male	50	14.42	18.96
BeauFish	2011	CB35	CB	220	-0.16	34.49	male	50	16.41	18.02
BeauFish	2011	CB35	CB	220	8.97	29.45	male	50	15.32	19.09
BeauFish	2011	CB28	CB	180	3.29	32.25	male	50	13.63	20.28
BeauFish	2011	CB29	CB	180	2.06	32.84	male	50	15.31	19.10
BeauFish	2011	WB02	WB	180	0.16	34.56	male	60	15.13	18.67
BeauFish	2011	WB13	WB	40	4.28	31.48	male	60	14.79	18.83
BeauFish	2011	CB35	CB	220	7.00	31.34	male	60	15.63	18.36
BeauFish	2011	CB35	CB	220	2.06	32.84	male	60	15.79	18.11
BeauFish	2011	CB35	CB	220	8.97	29.45	male	60	15.32	19.09
BeauFish	2011	CB34	CB	180	1.42	32.49	male	60	16.16	18.47
BeauFish	2011	CB1-350	CB	350	0.75	32.50	male	60	15.36	18.25
BeauFish	2011	CB1-350	CB	350	4.23	32.07	male	60	14.39	18.14
BeauFish	2011	WB07	WB	180	-0.88	33.22	male	70	15.07	18.05
BeauFish	2011	CB35	CB	220	0.16	34.63	male	70	15.28	19.79
BeauFish	2011	CB34	CB	180	8.97	29.45	male	70	16.23	18.46
BeauFish	2011	CB29	CB	180	1.09	32.56	male	70	14.78	18.02
BeauFish	2011	CB27	CB	180	9.35	29.21	male	70	13.86	19.33
BeauFish	2011	CB1-500	CB	200	6.68	31.33	male	70	15.42	19.55
BeauFish	2011	CB1-350	CB	350	6.86	31.52	male	70	15.23	18.69
BeauFish	2011	CB34	CB	180	9.10	30.60	male	80	15.71	18.31

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
BeauFish	2011	CB35	CB	220	7.00	31.34	male	80	15.28	19.79
BeauFish	2011	CB35	CB	220	9.35	29.21	male	80	15.79	18.11
BeauFish	2011	CBX-500	CB	500	4.53	31.98	male	80	16.82	19.06
BeauFish	2011	CB34	CB	180	8.97	29.45	male	90	16.61	18.15
BeauFish	2011	CB2-500	CB	500	2.18	32.37	male	90	16.05	18.85
BeauFish	2011	CBX-500	CB	500	1.42	32.49	male	90	16.19	18.61
BeauFish	2011	CBX-500	CB	500	4.23	32.07	male	90	16.25	19.80
BeauFish	2011	CB1-500	CB	500	3.29	32.25	male	90	16.02	19.05
BeauFish	2011	CB1-500	CB	500	0.75	32.50	male	90	15.26	19.28
BeauFish	2011	CB1-500	CB	500	0.75	32.50	male	100	14.97	19.66
BeauFish	2011	CB2-500	CB	500	7.00	31.34	male	110	16.22	19.47
BeauFish	2011	CB2-500	CB	500	6.68	31.33	male	110	14.86	19.80
BeauFish	2011	CB1-350	CB	350	6.86	31.52	male	110	15.80	18.93
BeauFish	2011	CB34	CB	180	6.86	31.52	male	120	15.70	18.77
BeauFish	2011	CB34	CB	180	8.97	29.45	male	120	15.39	17.99
BeauFish	2011	CB35	CB	220	2.06	32.84	male	120	15.63	18.36
BeauFish	2011	WB32	WB	80	1.09	31.96	mature female	30	13.05	18.19
BeauFish	2011	WB31	WB	180	-0.82	33.92	mature female	30	12.70	17.95
BeauFish	2011	WB28	WB	180	0.41	34.82	mature female	60	14.03	18.60
BeauFish	2011	CB28	CB	180	0.16	34.63	mature female	60	13.91	19.36
BeauFish	2011	CB27	CB	180	0.47	34.78	mature female	60	15.06	19.23
BREA	2013	BREA 4	CAB	343	0.47	31.01	male	80	13.66	19.23
BREA	2013	BREA 11	CAB	200	-1.02	33.68	male	100	13.44	20.43
BREA	2013	BREA 20	CAB	200	-1.02	33.68	male	100	14.85	18.92
BREA	2013	BREA 22	CAB	343	0.47	31.01	male	100	14.66	19.00
BREA	2013	BREA 25	CAB	343	0.47	31.01	male	100	13.95	19.98
BREA	2013	BREA 29	CAB	343	0.47	31.01	male	100	13.64	20.76
BREA	2013	BREA 30	CAB	343	0.47	31.01	male	100	13.14	19.36
BREA	2013	BREA 2	CAB	200	-1.21	33.54	male	110	14.05	18.92
BREA	2013	BREA 3	CAB	350	0.52	34.80	male	110	14.85	17.93
BREA	2013	BREA 9	CAB	200	-1.02	33.68	male	110	13.82	19.96
BREA	2013	BREA 12	CAB	350	0.60	34.80	male	110	15.17	19.44
BREA	2013	BREA 16	CAB	200	-1.02	33.68	male	110	14.89	19.35
BREA	2013	BREA 21	CAB	200	-1.02	33.68	male	110	14.60	19.21
BREA	2013	BREA 24	CAB	343	0.47	31.01	male	110	15.21	18.50
BREA	2013	BREA 27	CAB	343	0.47	31.01	male	110	14.07	18.74
BREA	2013	BREA 8	CAB	394	0.42	34.84	male	120	14.45	19.07
BREA	2013	BREA 10	CAB	200	-1.02	33.68	male	120	14.44	18.73
BREA	2013	BREA 14	CAB	200	-1.02	33.68	male	120	13.61	19.07
BREA	2013	BREA 15	CAB	394	0.42	34.84	male	120	15.25	18.77
BREA	2013	BREA 19	CAB	200	-1.02	33.68	male	120	15.54	19.73
BREA	2013	BREA 26	CAB	343	0.47	31.01	male	120	13.89	21.50
BREA	2013	BREA 1	CAB	198	-1.42	32.97	male	130	14.41	18.66
BREA	2013	BREA 5	CAB	339	0.31	34.90	male	130	16.30	19.48

Cruise	Year	Station	Region code	Water depth (m)	Bottom Temp. (°C)	Bottom salinity	Sex class	Size class (mm CW)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)
BREA	2013	BREA 6	CAB	42	-0.87	31.66	male	130	12.72	20.52
BREA	2013	BREA 7	CAB	200	-1.02	33.68	male	130	14.75	18.65
BREA	2013	BREA 13	CAB	343	0.47	31.01	male	130	14.39	19.86
BREA	2013	BREA 17	CAB	343	0.47	31.01	male	130	14.96	18.64
BREA	2013	BREA 28	CAB	343	0.47	31.01	male	130	15.47	20.20

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources, protecting our fish, wildlife and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island communities.

The Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management (BOEM) works to manage the exploration and development of the nation's offshore resources in a way that appropriately balances economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.